Prepared for: **U.S. Environmental Protection Agency - Region IX, Superfund Enforcement Branch and Montrose Chemical Corporation of California**

FIELD SAMPLING PLAN

NORTHWEST CORNER OF FORMER MONTROSE CHEMICAL PLANT LOS ANGELES COUNTY, CALIFORNIA

JULY 19, 1996

Prepared by:

McLaren Hart
ENVIRONMENTAL ENGINEERING

Field Sampling Plan

McLaren/Hart Project No. 03.0602239.007.001

Northwest Corner of Former Montrose Chemical Plant Los Angeles County, California

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Prepared for: **U.S. Environmental Protection Agency - Region IX, Superfund Enforcement Branch**
and
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1.0 OBJECTIVE

The former Montrose Chemical Plant, located at 20201 Normandie Avenue, Los Angeles County, California, is the site of a former pesticide manufacturing facility. Previous investigations on the property have confirmed the presence of pesticides, including dichlorodiphenyltrichloroethane (DDT) and hexachlorocyclohexane (BHC). Additionally, volatile organic compounds (VOCs) have been detected at other areas of the property. A Remedial Investigation (RI) was conducted at the property in accordance with United States Environmental Protection Agency (EPA) Administrative Order of Consent, EPA Docket Number 85-04. Results of the RI were presented in a 1992 report prepared by Hargis + Associates, Inc. (Hargis + Associates, 1992).

Subsequent to the RI, the EPA became aware of soil sampling information indicating that high levels of DDT once existed in the soil on the northwestern corner of the property. This information included data showing higher levels of DDT in soils on the northwest corner of the property than those reported in the RI report. This information was generated by soil sampling and analysis activities conducted by Stauffer Chemical Company during July 1983. The present investigation has been requested by the EPA to further assess soil conditions in the northwest corner of the Montrose Chemical Plant (Montrose property). This investigation will also evaluate soil conditions at off-property areas that adjoin the north and west property boundaries of the property.

The specific objectives of this investigation are as follows:

- Assess the degree and extent of DDT concentrations in soils at areas sampled by Stauffer in 1983;
- Evaluate soils at specific historical property features;
- Evaluate soils at former sampling points that revealed elevated DDT or BHC levels, inside the former "trash dike", "salvage area" and "junk yard";
- Assess the degree and extent of DDT and BHC concentrations in soils off-property to the north and west of the northwest corner of the property; and
- Screen for the potential presence of VOCs in the subsurface of the northwest corner of the property.

Using DDT as the primary indicator chemical, samples will be analyzed by a combination of screening level immunoassay tests for DDT and a modified EPA Method 8080 (EPA 8080) analyses. Use of the immunoassay testing will allow for cost effective area-wide screening. EPA 8080 analyses will be performed on a representative number of samples to confirm immunoassay results and to provide data of sufficient quality to quantify chemical levels in soils.

This Field Sampling Plan (FSP) was prepared in conjunction with the Quality Assurance Project Plan (QAPP) for the investigation (McLaren/Hart, 1996), and together, compose the Sampling and Analysis Plan (SAP) for the project. Specific quality control procedures required for the investigation are presented in the QAPP. The sampling rationale and sampling strategy is presented in the following sections.

2.0 BACKGROUND

This section presents a description of the property location and environmental setting, and discussions of historical or current property features relevant to the development of the sampling plan.

2.1 SITE LOCATION AND DESCRIPTION

The Property is located at 20201 Normandie Avenue in the County of Los Angeles, California. A site location map is presented on Figure 1 and the site layout is shown on Figure 2. The Property covers approximately 13 acres in the County of Los Angeles near Torrance, California. The Property is bounded by the Southern Pacific Railroad (SPRR) right-of-way and Normandie Avenue to the east; Jones Chemical Company and a right-of-way owned by the Los Angeles Department of Water and Power (LADWP) to the south; and a McDonnell Douglas Corporation (McDonnell Douglas) Property to the north and west.

2.2 ENVIRONMENTAL SETTING

Information on the site environmental setting was derived from the 1992 Hargis + Associates RI report. The Montrose property is located in the Torrance Plain, which is a portion of the Los Angeles Coastal Plain. The Torrance plain is a marine plain which historically was broad, featureless, and poorly drained. Dominguez creek, located approximately one mile northeast of the property was channelized beginning in 1930 to drain marshy areas and provide flood control.

The average daily temperature range is from approximately 55 degrees to 70 degrees Fahrenheit. The prevailing wind is from the west and southwest, however lighter night and early morning winds occur from the east and northeast. Average annual precipitation is approximately 11 to 12 inches per year.

Three geologic units comprise the unsaturated soils at the property: Recent Playa deposits, the late Pleistocene Palos Verdes sand, and the upper portion of the Pleistocene Bellflower aquitard. According to the RI report, the Playa Deposits consist of clayey silt, silty clay, and clay, and extend to a depth of 20 to 25 feet across the property. All soil sampling during this investigation is expected to be within the Playa Deposits.

First groundwater is anticipated to lie at a depth of 65 feet below ground surface (bgs). It is not anticipated that groundwater will be encountered during this investigation.

2.3 SITE HISTORY

Prior industrial activity in the vicinity of the Montrose property consisted of a paint manufacturing plant that began operation in approximately 1934. The paint manufacturing plant ceased production in the late 1930's, and no activity occurred on the property until the early 1940's. From the early 1940's until approximately 1952, sulfuric acid was produced in the area immediately south of the Montrose property where the Jones Chemical Company is presently located. In 1947, approximately 13 acres of land that is now referred to as the Montrose property was leased by Montrose Chemical Corporation. Montrose manufactured DDT on the property from 1947 until the plant closed in mid-1982. In addition to the operations conducted by Montrose, a hexachlorocyclohexane (BHC) pilot plant and small-scale high gamma production facility was operated by Stauffer Chemical in the southeast portion of the property during the period from approximately 1954 to 1963.

The Montrose manufacturing facility was periodically modified during its operation. The facility generally consisted of a DDT-processing building, water recycling pond, cooling tower, a formulating plant (constructed in 1964), warehouses, electrical transformer station, acid recovery area, and various maintenance, storage, and office buildings. All DDT manufacturing activities took place in the "central process area" of the property. The present investigation focuses on the northwest corner of the property, which is the area immediately west of the "central process area".

A map of the Montrose facility dated August 1963 ("oversized document SCC 16353"), which was included with results of the 1983 Stauffer soil sampling event (Stauffer, 1983), identified several features located in the northwest corner of the property, including a storage and salvage area for miscellaneous debris and equipment related to Montrose's operations. Three features of potential environmental concern identified on this map are the "trash dike", the "salvage area", and the "junk yard". The location of these areas are shown on Figure 2.

The Montrose plant was demolished between June and August 1982. During July 1983, Stauffer collected soil samples from several areas of the Montrose property, including an area covering approximately 100 by 400 feet, which is generally aligned with the prior location of railroad spurs.

Composite soil samples were collected by Stauffer in the northwest corner of the property. The reported results of this sampling event are presented on Figure 3 with results of other sampling events in the northwest corner of the property.

In April 1985, the entire property was graded and capped with asphalt to prevent air or surface water transport of soil, and to minimize surface water infiltration. According to historical and current grading plans (James O'Malley & Associates, undated) and cross section A-A' of the Hargis + Associates report (Hargis + Associates, 1992), the northwest corner of the Montrose property was cut approximately 1 to 3 feet below the previous grade. The pre-grading topographic contours are presented on Figure 2. Post-grading topographic contours and the estimated soil surface elevation change in the northwest corner of the property are shown on Figures 4 and 5, respectively. Prior to grading, ground surface elevations in the northwest corner were approximately 48 to 51 feet above mean sea level. Ground elevations in the same area after surface grading and asphalt cap construction were 47 to 48 feet above mean sea level (James O'Malley & Associates, May 19, 1985). This information suggests that up to 3 feet of surface soils may have been graded from the locations. Soils previously sampled by Stauffer were cut from the area during regrading operations.

2.4 AERIAL PHOTOGRAPH REVIEW OF THE SITE

In March 1996, the EPA provided Montrose with a set of aerial photographs dated from 1941 to 1989 from which potential areas of environmental concern were identified. The historical features previously identified by Stauffer ("oversized document SCC 16353") are evident in the photographs. These areas and additional areas of concern identified by the EPA's aerial photograph review are shown on Figure 2. The features were plotted on Figure 2 based on the scale cited on the aerial photos.

A railroad spur track running north-south approximately bisected the northwest corner. The spur is evident in photographs up to 1962. The "trash dike" and "salvage area" are located to the east of the spur, while the area west of the tracks appears to be undeveloped for the entire time period reviewed. The "junk yard" is located in the extreme north corner of the property.

The “trash dike” area appears to be enclosed by a rectangular wall located in the south central portion of the northwest corner adjacent to the spur track. This area can be seen in photos from 1952 to 1980. No objects can be distinguished within the "trash dike", although the presence of a wall on all sides suggests that surplus material could have been stored in this location. The area immediately north of the "trash dike" occasionally had evidence of materials storage.

The "salvage area" also appears on aerial photographs from 1952 to 1980. This large area is located east of the "trash dike", adjacent to the central plant area. Large objects are frequently visible in this area, suggesting storage of containers or equipment.

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The "junk yard" is located in the extreme northwest corner of the property, but did not appear to have well defined boundaries. Aerial photographs of this area occasionally had evidence of irregular piles of material.

The area west of the rail spur intermittently had evidence of material accumulation such as surface discoloration and piles of soil or other material.

2.5 PRIOR NORTHWEST CORNER SOIL SAMPLING RESULTS

Four previous episodes of soil sampling and analysis have been conducted in the northwestern corner of the Montrose property. The results of the previous sampling events were summarized in the RI (Hargis + Associates, 1992). A total of 158 samples were collected and analyzed from 40 locations between 1983 and 1986. Results of these investigations are summarized on Figure 3.

In June and August of 1983, Hargis & Montgomery collected 24 soil samples at 12 locations. DDT concentrations ranged from 0.05 to 95,000 mg/kg (location S-24, near the western property border). Soil sampling depths ranged from 0.0 to 5.25 feet. Generally, samples collected below a depth of 1.5 feet had DDT concentrations of less than 50 mg/kg.

In July 1983, Stauffer collected and analyzed 31 samples at 24 locations in the northwest corner of the property. Detectable levels of DDT were found in all samples analyzed. Samples were noted as being collected from trenches (A), piles (B), or core samples (C). The majority of the Stauffer samples were collected along two north/south rows, parallel to the rail road spurs near the western fence line. The highest DDT concentration reported was 710,000 mg/kg (location 02/02 - trench sample). Soil sampling depths ranged from surface to 5 feet below ground surface (bgs), with the majority of samples collected at a depth of 1-foot bgs.

In June 1985, after the property had been graded and capped, Metcalf & Eddy performed soil sampling and analysis to further characterize the property. Forty-five soil samples were collected and analyzed from six locations. DDT concentrations ranged from non-detect to 3,880 mg/kg (location 21D). Soil sampling depths ranged from surface to 9 feet bgs. Generally, samples collected below a depth of 3.0 feet within the planned study area had low to non-detectable DDT concentrations.

The most recent round of soil sampling and analysis was conducted by Hargis + Associates in 1986. Fifty-eight samples were collected and analyzed from eight locations during the final soil sampling episode. DDT concentrations ranged from below detection limits to 760 mg/kg (location

JC3 at 1.75 feet). Soil sampling depths ranged from surface to 9.0 feet. Generally, samples collected below a depth of 3.0 feet had low to non-detectable DDT concentrations.

The only detectable concentration of BHC on or adjacent to the northwest corner was a sample collected by Hargis + Associates from boring MD-6. The sample collected from surface to 0.5 feet bgs had 0.715 mg/kg BHC. Other samples collected from depths down to 5.75 feet did not have detectable concentrations of BHC.

2.6 Current Property Features

The Montrose manufacturing plant was dismantled and demolished between June and August 1982. In 1983, a temporary earthen berm was constructed to prevent surface water runoff from leaving the Property. Subsequent activities conducted in early 1985 to minimize the potential for migration of contaminants and surface water infiltration included:

- Removing and crushing (on-property) of foundations and footings;
- Grading the majority of the property;
- Installing a concrete curb around the perimeter of the property; and
- Installing an asphalt cap to prevent surface erosion potential vertical migration of chemicals.

A chain link fence was constructed along the property perimeter to prevent public access. Property access is along Normandie Avenue through a locked gate.

Two Los Angeles County Sanitation District sewer lines are located along the east Property boundaries. The sewer lines are buried within the Property boundary at a depth of approximately 20 feet. Numerous underground pipelines are buried adjacent to the southern boundary of the Property in a pipeline corridor.

3.0 RATIONALE FOR SAMPLING AND ANALYSIS

This section presents the rationale for the sampling plan and specifies the number and type of samples to be collected. The former sampling locations and the proposed soil sample locations included in this sampling plan are shown on Figure 6. A summary of the areas to be sampled, the sampling locations and frequency, and the analyses to be performed is presented in Table 1. The sampling plan is based on the northwest corner being cut by 0 to 3 feet during the property-wide grading which occurred in 1985. If evidence of backfill is observed from the continuous cores, additional samples will be collected for analysis (see Section 5.0 - Field Methods and Procedures).

A portion of the planned sampling locations are intended to evaluate soil conditions at specific former Stauffer sampling points where elevated concentrations of DDT were reported. The approximate locations and area covered by the 1983 Stauffer sampling event has been estimated based on the grid lines and map scale included with the reported results (Stauffer, 1983). Former Stauffer sampling points of interest will be located in the field using the northwest fence corner (property boundary corner) as the reference point for retracing the Stauffer sampling grid. By aligning the northwest corner of the Stauffer sampling grid with the northwest corner of the property fence line, sample locations will be located in the field relative to the Stauffer sampling grid.

Discussions of the sampling objectives for the identified sampling areas at the property are presented below.

3.1 FORMER "JUNK YARD" (STAUFFER SAMPLE 02/02-01)

The former "junk yard" is located in the extreme northwest corner of the property. A soil sample collected at a depth of one-foot bgs by Stauffer in 1983 contained a DDT concentration of 710,000 mg/kg (Stauffer sample 02/02-01 - 7/24/83). This sample was reportedly collected from a trench located along the southern perimeter of the former "junk yard". Other soil samples collected by Stauffer in this area contained DDT concentrations of 31,000 and 4,100 mg/kg (Stauffer samples 02/01-01 - 7/25/83 and 00/03-01, respectively).

Two soil sampling points will be located within 5 feet east and west of the estimated grid point in the field. Based on the Stauffer information, the grid point (02/02-01) will be located 50 feet south of the north fence line and 50 feet east of the west fence line. Soil samples collected from these locations will be submitted for laboratory analysis to evaluate current chemical concentrations in this area.

Comparison of the pre- and post-grading elevations indicate that the top two feet of soil were removed from this area during the property grading in 1985 (see Figure 5) . The Stauffer samples in this area were collected within one foot of the ground surface. Soil samples will be collected from each location at 6-inch intervals from the soil surface and 2.5 to 3.0 feet below the asphalt surface and road base.

3.2 FORMER "SALVAGE AREA"

The former "salvage area" is a 215 foot by 145 foot area located on the eastern side of the northwest corner of the property. Review of historical aerial photographs indicate materials and possible containers were stored in this area between 1941 and 1980. A bermed tank area is evident on an October 1980 photo, which may correspond to the "oil storage" area shown on the 1982 plant operations map (Hargis + Associates, 1992). Six soil samples were collected from three locations within this area by Hargis & Montgomery in 1983 (S-5, S-5A, and S-11). Two surface samples contained DDT at concentrations of 6,800 and 58 mg/kg (samples S-5-0.0 and S-11-0.0 respectively). Deeper samples, from depths of 1.5, 2.0, 3.0, and 4.5 feet, had DDT concentrations of 120, 2.4, 1.3, and 1.3 mg/kg, respectively.

Four soil sample points will be located within the area of the former "salvage" area at the locations shown on Figure 6. The sample points are targeted at locations of features observed on the aerial photographs. One sample location (northeast sample) is near the approximate location of a former depression, one sample location (southeast sample) is in the vicinity of a former above ground tank, and two samples are in the western portion of the "salvage" area where materials and equipment appeared to have been stored.

Review of the pre- and post-grading contour maps indicates that up to two feet of soil was removed from this area during the grading in 1985. Soil samples will be collected from each location at 6-inch intervals from the soil surface and 2.5 to 3.0 feet below the asphalt surface and road base. Soil samples collected from these locations will be submitted for laboratory analysis to evaluate current chemical concentrations in this area.

3.3 AREA EAST OF FORMER MACHINE SHOP (STAUFFER SAMPLE 02/08-01&02)

Two soil samples collected at depths of 3 and 5 feet by Stauffer contained concentrations of 110,000 and 520 mg/kg DDT (Stauffer samples 02/08-01 and -02), respectively. The sample location is just east of the former machine shop and is estimated to be 200 feet east of the western property boundary and 50 feet south of the northern property boundary. The sample was collected in a trench or pit.

Two soil sampling points will be located within 5 feet east and west of this grid point. Two soil sampling points will also be located in a grid pattern as shown on Figure 6. The purpose of these samples is to evaluate if the results reported by Stauffer are representative of the post-grading soil conditions at this location. Comparison of the pre- and post-grading elevations indicate that the top two feet of soil were removed from this area during the grading in 1985. Planned sampling depth intervals corresponding to the Stauffer samples will therefore be at 1.0 to 1.5 and 3.0 to 3.5 feet below the asphalt surface and road base. Soil samples collected from these locations will be submitted for laboratory analysis to evaluate current chemical concentrations in this area.

3.4 FORMER "TRASH DIKE" AND VICINITY

The "trash dike" is a feature located on the south border of the northwest corner of the Montrose property. The 45-foot by 50-foot area was identified on the Stauffer 1963 map of the Montrose property. Review of historical aerial photographs indicate that this area was first used in 1952, and that materials were intermittently stored in the area until 1980. A location adjacent to the southeast corner of the "trash dike" was sampled by Metcalf & Eddy in 1985 (sample 22D). DDT was detected at a concentration of 821 mg/kg at the 1-foot sampling depth, and at a concentration of 2,359 mg/kg at the 1.5-foot sampling depth. Samples collected from depths of 2.5 feet to 9.0 feet (in 0.5-foot increments) were all below detectable levels. Review of historic aerial photographs indicated that light colored material was intermittently stored in the area north of the "trash dike".

Two sample points will be located within the former "trash dike", and two sample points will be located in the area north of the "trash dike", as shown on Figure 6.

Review of the pre- and post-grading contour maps indicates that up to 1 foot of soil was removed from this area during the grading in 1985. Soil samples will be collected from each location at 6-inch intervals from the soil surface and 2.5 to 3.0 feet below the asphalt surface and road base. Soil samples collected from these locations will be submitted for laboratory analysis to evaluate current chemical concentrations in this area.

3.5 HARGIS + ASSOCIATES BORING MD6

Boring MD6 was sampled by Hargis and Associates on April 29, 1986. The boring was located near the southwest boundary of the property. A sample collected from the depth interval of 0 to 0.5 feet had a BHC concentration of 0.715 mg/kg.

Two soil borings will be located approximately 10 feet from location MD6 as shown on Figure 6. Soil samples will be collected from each location at 6-inch intervals from the soil surface and

2.5 to 3.0 feet below the asphalt surface and road base . Soil samples collected from these locations will be submitted for laboratory analysis to evaluate current chemical concentrations in this area.

3.6 DDT Screening and Confirmation Sampling at the Northwestern Area

Nineteen samples have been collected from three off-property locations (Hargis + Associates borings MD4, MD5 and MD6) along the northern and western perimeter of the northwest corner. Concentrations of DDT ranged from below the detection limit (0.03 mg/kg) to 120 mg/kg at a depth of 1.0 feet in MD5. Additionally, on-property samples collected within 25 feet of the property border by Stauffer and by Hargis & Montgomery had DDT at concentrations of up to 95,000 mg/kg. Review of historic aerial photographs indicates that stockpiled materials have been stored in the northwest corner, particularly near the west border. As noted by EPA comments, stockpiles of lighter colored material were present in this area between 1958 and 1965, however the area appeared to be regraded with new soil cover in 1972. A systematic survey of the on-property and off-property soils is planned to evaluate the degree and extent of chemicals in this area.

As shown on Figure 6, sample locations have been laid out in a grid pattern, with the highest sample density being the area immediately adjacent to the property line. Thirty two off-property locations will be sampled within a 30-foot wide perimeter around the north and the west property boundaries. These locations are placed on a grid pattern, with locations lying either 10 or 30 feet outward from the property boundary, and spaced at 50 foot intervals.

The western off-property area has been regraded for parking by McDonnell Douglas. Graded soil is stockpiled west of the extreme northwest corner of the property. A minimum of four samples will be collected from the stockpile if coverage by at least four sampling points is not provided by the grid layout.

Twenty four on-property locations will be sampled in a grid pattern as shown on Figure 6. The sampling grid will cover the area previously sampled by Stauffer and the former whitish stockpile noted in the aerial photographs. The first row of six locations are spaced 50 feet apart and are located 10 feet east of the western border. Sampling locations in the next three rows are also spaced 50 feet apart, with rows planned at 60, 110, and 160 feet east of the western border.

Review of pre and post-grading contour maps indicate that two to three feet of soil was cut from the western border area during the on-property grading work in 1985. It is expected therefore that native soil is present directly below the asphalt cap. Soil samples will be collected from each location at 6-inch intervals from the soil surface and 2.5 to 3.0 feet below the asphalt surface and road base (for on-property locations) or existing soil surface (for off-property locations).

An immunoassay test for DDT will be performed on each sample collected from the grid sampling areas. Duplicate confirmation samples will be collected and analyzed at a fixed laboratory for EPA 8080 at a rate of twenty percent of the samples analyzed by immunoassay testing. These samples will collected by drilling an additional borehole within a 1-foot radius of the original location and collecting a 6-inch sample core from the same depth interval. The rationale for selecting duplicate confirmation samples for EPA 8080 analysis is discussed in Section 4 (Field Methods and Procedures) and is the responsibility of the Project Manager.

3.7 VOC Screening

Due to the detection of VOCs in other areas of the property and the former presence of waste or storage areas in the northwest corner of the property, selected soil samples collected from the "junk yard", "salvage area" and vicinity, "trash dike" and vicinity, and near Boring MD6 will be submitted for CLP VOC analysis. Samples will be submitted for CLP VOC analysis at the rate indicated in Table 1 if no field indication of VOCs is detected (headspace readings or odors - see Section 4 for description of field screening procedures). Field screened samples that have measurements higher than the range for background ambient air, will be submitted for CLP VOC analysis. If evidence of VOCs is not noted, samples will be selected for CLP VOC analysis based on their position to provide screening coverage across the study area. The Site Field Supervisor and Project Manager will select samples for CLP VOC analysis according to site conditions encountered.

3.8 Quality Control Samples

Quality Control analyses will also be performed by EPA 8080 and CLP VOC methods in accordance with the requirements presented in the QAPP (McLaren/Hart, 1996). The QC samples required to be submitted for analysis by the field team include:

- Equipment rinse blanks - one per day of sampling per analysis type collected (EPA 8080 and CLP VOCs);
- Replicate samples - one per 20 samples collected per analysis type (EPA 8080 and CLP VOCs);
- Matrix spike/matrix spike duplicate (MS/MSD) samples - one per 20 samples collected per analysis type (EPA 8080 and CLP VOCs); and
- Trip blanks - one per ice chest shipped containing VOC soil samples.

Equipment rinse blanks will consist of the final de-ionized water rinse from the decontamination procedure (see Section 5). Replicate and MS/MSD samples will be collected by drilling an additional borehole within a 1-foot radius of the original location and collecting a 6-inch sample core from the same depth interval. Trip blanks will consist of laboratory grade certified pure water prepared by MBT Laboratories.

3.9 SAMPLE ANALYSES

Analytical methods for the project will include EPA 8080 and CLP VOC analyses, and EnviroGard™ DDT immunoassay testing. Relevant method references, quantification limits, and QC elements for the planned analyses are presented in the project QAPP (McLaren/Hart 1996). Samples will be submitted for analysis as listed in Table 1. Sample hold times and container requirements are presented in Table 2.

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4.0 FIELD METHODS AND PROCEDURES

A description of specific procedures and associated equipment for completing the planned field investigation is presented in this section. The following procedures are described:

- Sample Collection;
- Equipment Decontamination;
- Disposal of Contaminated Materials;
- Field Measurement Procedures;
- Documentation; and
- Sample Packaging and Shipping.

4.1 SAMPLE COLLECTION

This section presents procedures for collecting and submitting samples for appropriate analyses. Procedures for collecting and logging soil samples using a Geoprobe®, and selecting samples for confirmation analyses are presented below.

4.1.1 Drilling and Sampling Procedures

All soil samples will be collected utilizing the Geoprobe® system. Use of the Geoprobe® apparatus will minimize potential damage to the asphalt cap and will minimize the costs associated with disposal of soil cuttings and decontamination effluent generated during field work. A Geoprobe® SOP (prepared by ICF Kaiser International, Inc., 1993) is provided in Appendix A. A McLaren/Hart field geoscientist will supervise the drilling and sampling activities.

Boreholes will be advanced by collecting continuous cores with the "Macro-Core" sampler, which is approximately 4 feet long. The sampling process will allow the on-site geologist to observe potential changes in physical soil characteristics and to screen for chemical occurrences over the entire borehole depth. Soil samples are contained in 1 1/2-inch diameter by 45-inch long polyethylene terephthalate glycol (PETG) tubes by driving a 4-foot long stainless steel sampler equipped with an internal, moveable piston to a position just above the desired sampling depth. After the sampler is properly positioned, the internal piston is released. The piston drives the sampler lined with the soil sample tube forty-eight inches ahead of (deeper than) the Geoprobe® tool, allowing undisturbed soil to enter the sampler lined with a PETG tube. The sampler is then withdrawn and the soil sample is removed from the sampler.

Samples will be collected from the PETG tubes at the specified sampling depths. Selected 6- inch sections of the PETG tube will be cut from the 45-inch long soil core and prepared for shipment to the laboratory. Sample tubes will be sealed with squares of Teflon sheeting and plastic end caps, labeled, and stored in a cooled ice chest. The sample label will identify the date the sample was collected, the sample location, the analyses required, and the sampler's initials. Two sampling intervals are planned at each location providing that backfill or other discontinuities are not encountered. If buried wastes or apparent fill material is encountered, samples will be collected from a 6-inch interval directly above and below the discontinuity or from the material itself, if warranted.

The sample core will be logged according to the Unified Soil Classification System and include a description of the texture, color, moisture content, hydrocarbon odor, and other distinguishing characteristics. A portion of the core immediately below (for surface samples) or above (for subsurface samples) the interval submitted for laboratory analysis will be placed into a locking plastic bag for headspace analysis. The bag will be sealed immediately and left to stand for a few minutes to allow volatile gases to enter the headspace of the bag. A photoionization detector (PID) or flame ionization detector (FID) calibrated to isobutylene will be used in the field to analyze the headspace gases. Headspace readings will be included on the soil boring logs. Records of the field sampling activities will be depth as discussed later in the Documentation section.

All boreholes will be abandoned by filling the holes with neat Portland cement or with hydrated bentonite. The top of the boreholes located in asphalt areas will be covered with cold patch asphalt.

All duplicate confirmation, replicate, and MS/MSD samples will be collected within a 1-foot radius of the original sample location at the same depth interval.

4.1.2 Sampling Sequence and Analysis Strategy

Sampling will be conducted in a specific sequence to allow for selection of the most representative samples for EPA 8080 and CLP VOC analyses. Grid sample locations for immunoassay testing will be collected first and submitted to the laboratory for immediate immunoassay testing. Sampling locations at specific target areas (i.e. trash dike, junk yard, etc.) will be conducted after the grid sampling for immunoassay testing is completed. Based on the results of the immunoassay testing, duplicate confirmation samples will be collected for EPA 8080 analyses from boreholes drilled within a 1-foot radius of the original sampling point.

Duplicate confirmation sampling points will be selected by the Project Manager to confirm the relative accuracy of the immunoassay tests, verify the limits of DDT contamination, and quantify the upper range of DDT concentrations detected. Soil samples to be submitted for CLP VOC analysis will be selected by the Project Manager and Field Supervisor based on field screening observations during sample collection. A minimum of eight soil samples will be submitted for CLP VOC analysis, as listed in Table 1. If requested, the EPA may provide input for the selection of samples for EPA 8080 and CLP VOC analyses.

4.2 EQUIPMENT DECONTAMINATION

Non-dedicated equipment used for sample collection will be thoroughly decontaminated prior to each use. PETG tubes used for soil sampling will not be reused. Equipment decontamination procedures will be as follows:

1. Wash with non-phosphate detergent and tap water and scrub inside and outside of equipment with a bottle-brush.
2. Rinse equipment with tap water.
3. Rinse equipment with deionized/distilled water.
4. Rinse equipment with pesticide-grade solvent.
5. Rinse equipment with deionized water.
6. Rinse equipment with HPLC-grade organic free water.
7. Allow equipment to dry.

4.3 WASTE MATERIALS DISPOSAL PROCEDURES

The following waste materials will be generated from this investigation:

- Excess PETG tubes;
- Used Personal Protective Equipment;
- Decontamination fluids; and
- Excess soil cuttings from the Geoprobe sampling.

Used PPE and disposable equipment will be double-bagged and transported to a municipal refuse dump. These wastes are not anticipated to be hazardous and can be sent to a municipal landfill. Reusable PPE, such as rubber boots, goggles, etc., will be cleaned with a non-phosphate detergent and tap water. Decontamination fluids will consist of water and pesticide-grade organic solvent. The volume and concentration of the decontamination fluid will be sufficiently low as to allow evaporation on the site. All excess soil cuttings will be contained and stored in DOT 17H drums for proper disposal.

4.4 FIELD MEASUREMENT PROCEDURES

This section presents air monitoring procedures as part of the project health and safety requirements, the sample headspace screening technique, and borehole mapping procedures.

4.4.1 Air Monitoring and Sample Head Space Screening

Air monitoring, to assure worker safety during field operations, will be completed according to the project Health and Safety Plan (HASP). Equipment to be used for air monitoring may include a PID, FID, or colorimetric (Draeger) tube system. Instruments will be calibrated and used in accordance with manufacturer's operation manuals. The frequency for instrument calibration and air monitoring for the project will be specified in the HASP. A site HASP will be prepared and approved before beginning field operations.

In addition to air monitoring to maintain worker safety, borehole headspace screening will be conducted with a PID/FID during drilling operations as an aid to describing and evaluating site conditions. Borehole headspace measurements will be collected at regular intervals using a PID or FID during drilling operations. The measurements will be recorded and used to evaluate the potential presence of organic contaminants at areas of concern.

Additionally, headspace from sample cores will be screened and included in the descriptions recorded on the soil drilling logs. A soil volume from each depth interval sampled will be placed in a sealable plastic bag and placed in a warm environment so that potential chemicals in the soil will volatilize. Headspace readings from the plastic bags will collected by inserting the instrument intake tube into the bag and recorded on the appropriate forms.

Results of the field screening activities will be reviewed by the Project Manager to evaluate whether additional laboratory analyses are warranted.

4.4.2 Mapping Borehole Locations

Borehole locations will be flagged in the field and plotted on a site map to identify locations for potential confirmation or follow-up sampling. Sampling locations will be marked in the field after each borehole is completed using survey stakes or wire flags. The location of each sampling point will be referenced to the northwest fence corner at the property by measuring the distance north/south and east/west from this benchmark. The measurements will be recorded in field sampling logs and on a site map.

4.5 DOCUMENTATION

Sample documentation forms will be used to record sample identity, analytical parameters, sample conditions and integrity, and sample custody. All field personnel will maintain a daily log book of field activities documenting sampling events. The daily log will be recorded in a bound record book with numbered pages and include the following information as applicable:

- date and time of starting work;
- names of field personnel conducting work;
- purpose of field activity;
- description of work area and sampling location;
- description of field activity, including any deviation from the work plan;
- field observations;
- air monitoring measurements or observations; and
- sample handling and shipping information.

Pre-printed sample labels will be prepared before starting daily field activities. Information such as the samplers name and time of collection will be completed at the time of sampling. Sample labels will be printed with indelible ink and include the following information:

- Name of Sampler;
- Date and Time of Collection;
- Sample Designation;
- Sample Matrix;
- Preservation Method; and
- Analyses Required.

A sample chain of custody (COC) form will be completed with the required information to identify requested sample analyses and sample custody. The information required to be recorded on the COC will include the following:

- Project name and number;
- Sampler's name and signature;
- Sample identification numbers;
- Sampling date, time, and location;
- Requested analyses;
- Sample container type and quantity;
- Sample preservation;
- Requested analytical turn-around-time; and

- Name of analytical laboratory receiving samples.

An example COC form is presented on Figure 7.

A record of the drilling and sampling procedures and observations will be kept on a Field Soil Drilling Log, as shown on Figure 8. The following information will be included on the logs:

- sampling location, designation, and sampler;
- project designation and location;
- sampling date, time, and method;
- lithologic descriptions;
- sample interval;
- sample identification; and
- PID or FID readings.

4.6 Sample Packaging and Shipment

Sample packaging and shipping procedures will assure that samples are properly preserved, protected, and secured until delivery to the analytical laboratory. After samples are labeled, all sample containers will be placed in sealed plastic bags or wrapped with clear packaging tape to protect sample labels from potential moisture damage. All fragile sample containers will be protected from breakage by wrapping containers with suitable packaging material (such as bubblewrap) and placed upright in thermally insulated chests. Ice will be double-bagged in sealed plastic bags and placed on top of samples in order to maintain a temperature of approximately 4°C until delivery of samples to the analytical laboratory. Any remaining void space in the ice chest will be filled with appropriate packaging material. An express service (typically Federal Express) air bill will be completed and the air bill number will be recorded on the COC accompanying each ice chest. The COC will be sealed in a plastic bag and taped to the underside of the ice chest lid. The ice chests will be sealed closed with filament tape and a security seal will be placed on the ice chest lid. The security seal will indicate whether any tampering occurred during handling and shipment. Samples will be sent to MBT daily via express priority delivery service. MBT will be notified prior to shipping samples in the event that samples would arrive at the laboratory on a weekend or holiday to assure that the samples are properly received.

5.0 HEALTH AND SAFETY

All on-site field work will be conducted in accordance with an approved site-specific Health and Safety Plan (HASP). The HASP will be prepared and approved before the start of field activities. The project HASP will be bound under separate cover from this FSP. On-site field personnel will have 40-Hour Hazardous Waste Operations and Emergency Response training and current 8-Hour Refresher Training in accordance with 29 CFR 1910.120. Field personnel will also have certification of current respirator fit-testing and first aid training.

6.0 REFERENCES

Hargis + Associates, Inc. October 29, 1992. Final Draft Remedial Investigation, Montrose Site, Torrance, California; Volumes I through IV.

ICF Kaiser International, Inc. July 13, 1993. Region 9 FASP Standard Operating Procedure F93014, Operation of the Geoprobe for Soil Vapor, Soil Core, and Groundwater Sampling.

____. June 16, 1994. Region 9 FASP Standard Operating Procedure F93025, Analysis of Pesticides in Soil Samples by EnviroGard DDT Soil Test Kit.

James O'Malley & Associates, Inc. Undated. D size figure - Historic Surface Water Drainage and Pre-grading Site Topography

_____. May 19, 1985. D size Figure - Post-grading Topography

McLaren/Hart Environmental Engineering. July 1996. Quality Assurance Project Plan, Northwest Corner of former Montrose Chemical Plant, Los Angeles County, California.

Stauffer Chemical. August 1983. Inter-Office Correspondence, Subject: DDT Analysis of Soils at Torrance Site.

Table 1
Sample Locations, Depths and Analytical Schedule
Northwest Corner of Montrose Property

Sample Area	Reason for Sample Collection	Location Designation	Depth of samples *	Analyses (Total Number of Samples)
On-property Screening	Historic material storage	SB-1 thru SB-22	Soil Surface 2.5 - 3.0 bgs	DDT by Immunoassay (44)
On-property Confirmation	Screening Confirmation Samples	SB-1C thru SB-22C	Soil Surface 2.5 - 3.0 bgs	20% by EPA 8080 (9)
Off-property Screening	Off-site migration from historic material storage	SB-23 thru SB-54	Soil Surface 2.5 - 3.0 bgs	DDT by Immunoassay (64)
Off-property Confirmation	Screening Confirmation Samples	SB-23C thru SB-54C	Soil Surface 2.5 - 3.0 bgs	20% by EPA 8080 (13)
former "Junk Yard" (Stauffer 02/02-01)	710,000 mg/kg DDT detected by Stauffer; past material storage	SB-55 thru SB-58	Soil Surface 2.5-3.0 bgs	EPA 8080 (8) CLP VOCs (2) **
Vicinity of former Machine Shop (Stauffer 02/08-01)	110,000 mg/kg DDT detected by Stauffer	SB-59 thru SB-62	1.0- 1.5' bgs *** 3.0 - 3.5 bgs ***	EPA 8080 (8) CLP VOCs (2) **
former "Salvage area"	Historic material storage; 6,800 mg/kg detected in 1983	SB-63 thru SB-66	1.0 - 1.5' bgs 2.5 - 3.0 bgs	EPA 8080 (8) CLP VOCs (2) **
former "Trash Dike" and vicinity	Historic material storage; 2,389 mg/kg DDT detected in 1985	SB-67 thru SB-70	Soil Surface 2.5 - 3.0 bgs	EPA 8080 (8) CLP VOCs (2) **
Boring MD6	0.715 mg/kg BHC detected in 1986	SB-71 thru SB-72	Soil Surface 2.5 - 3.0 bgs	EPA 8080 (4) CLP VOCs (1) **
Quality Control Samples	Replicate EPA 8080 samples	Blind Replicate ****	one per 20 CLP samples collected	EPA 8080 CLP VOCs
	MS/MSD	MS/MSD ****	one per 20 total samples	EPA 8080 CLP - VOCs
	Equipment Rinse Blanks	ER - (date)	one per day of sampling	EPA 8080 CLP - VOCs
	Trip Blanks	TP - (date)	one per shipping container tested for VOCs	CLP - VOCs

* Excluding SB-61 and SB-62, the first sample collected in each boring will be from the surface soil immediately below the asphalt cap, or from the soil surface if unpaved.

** This is the minimum number of samples to be analyzed for VOCs. Samples will be selected based on field screening.

*** Collect samples from depth intervals listed for comparison to previous sample depths in this area.

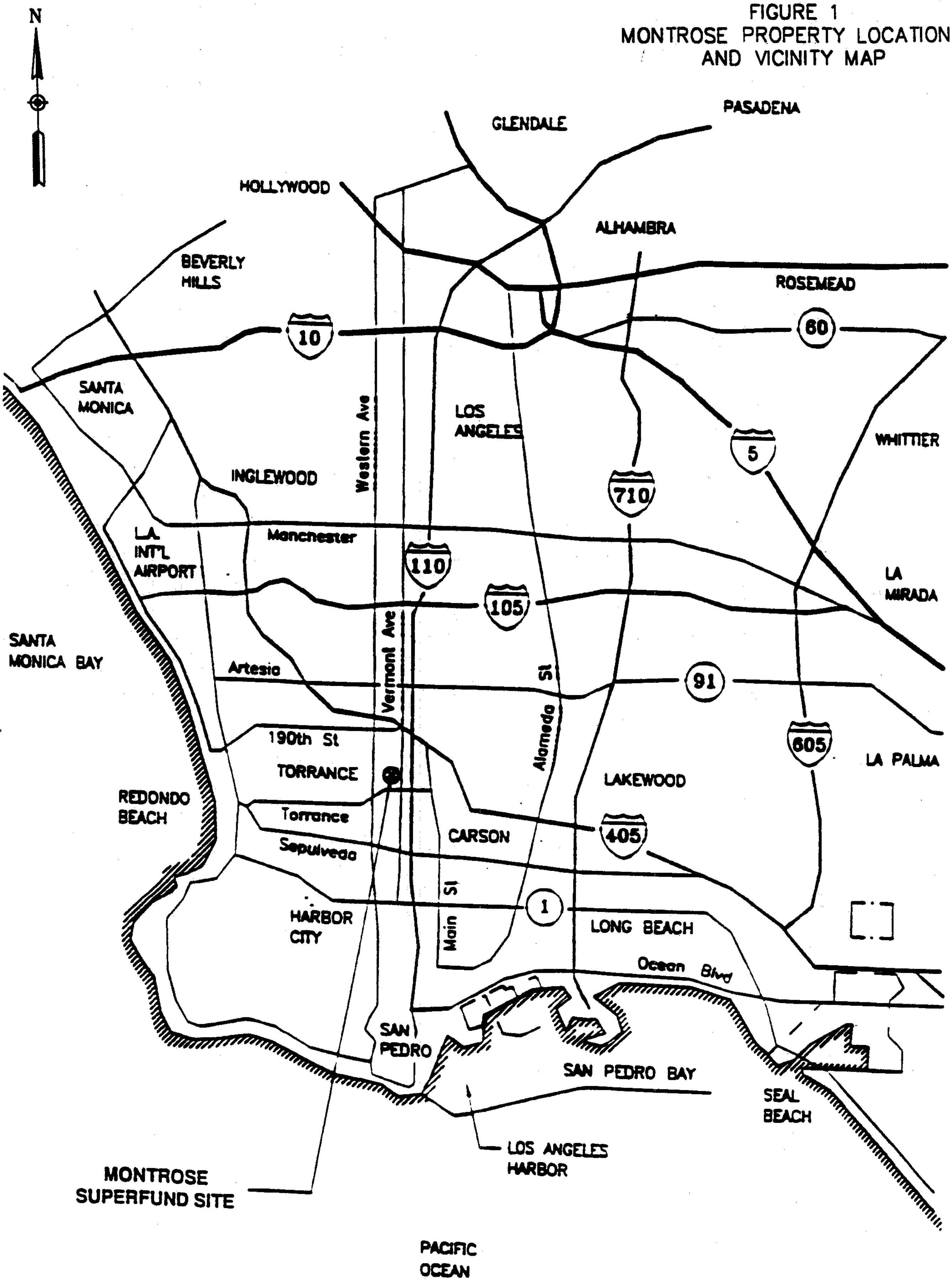
**** Matrix Spike/Matrix Spike Duplicate - Assign as MS/MSD for adjacent soil boring number/depth. Blind replicate - Assign fictitious sample location and record in log book with association to adjacent soil boring number/depth.

Table 2
Sample Containers, Preservation and Holding Times
Northwest Corner of Montrose Property

Analysis Type	Analysis method	Matrix	Container	Preservation	Holding Time
VOCs	CLP VOCs	Soil	1 1/2" diameter PETG (clear plastic) Liners	Cool to 4 degree C.	14 Days
		Water	4: 40 ml VOA	HCL to pH <2; Cool to 4 degree C.	14 Days
Pesticides	EPA 8080	Soil	1 1/2" diameter PETG (clear plastic) Liners	Cool to 4 degree C.	7 Days (extraction) 40 Days (analysis)
		Water	2: 1-liter glass	Cool to 4 degree C.	7 Days (extraction) 40 Days (analysis)

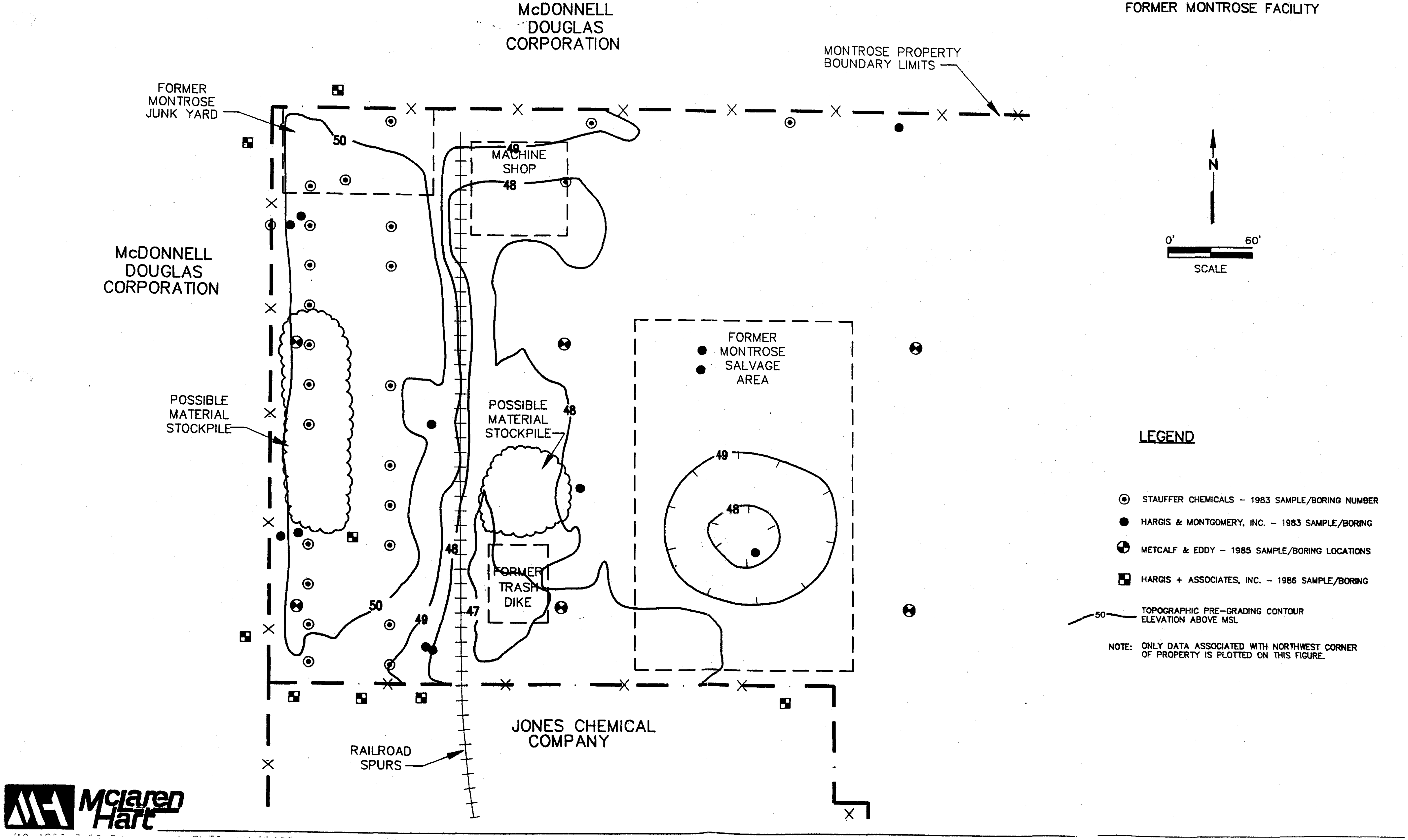
BOE-C6-0063963

FIGURE 1
MONTROSE PROPERTY LOCATION
AND VICINITY MAP



McLaren Hart

FIGURE 2
SITE LAYOUT
NORTHWEST CORNER OF
FORMER MONTROSE FACILITY



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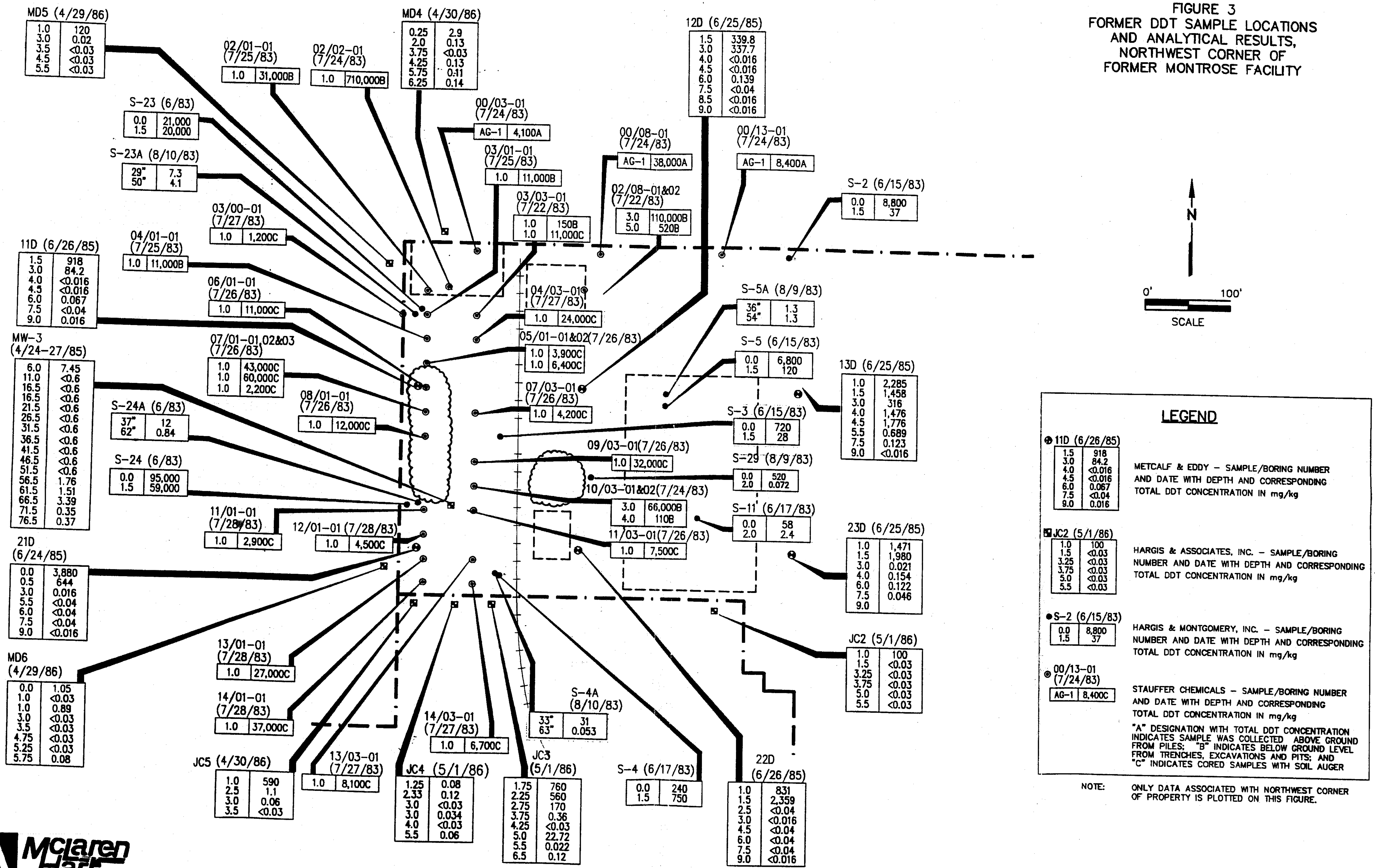

FIGURE 3
FORMER DDT SAMPLE LOCATIONS AND ANALYTICAL RESULTS, NORTHWEST CORNER OF FORMER MONTROSE FACILITY

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FIGURE 4
POST-GRADING CONTOURS
NORTHWEST CORNER OF
FORMER MONTROSE FACILITY

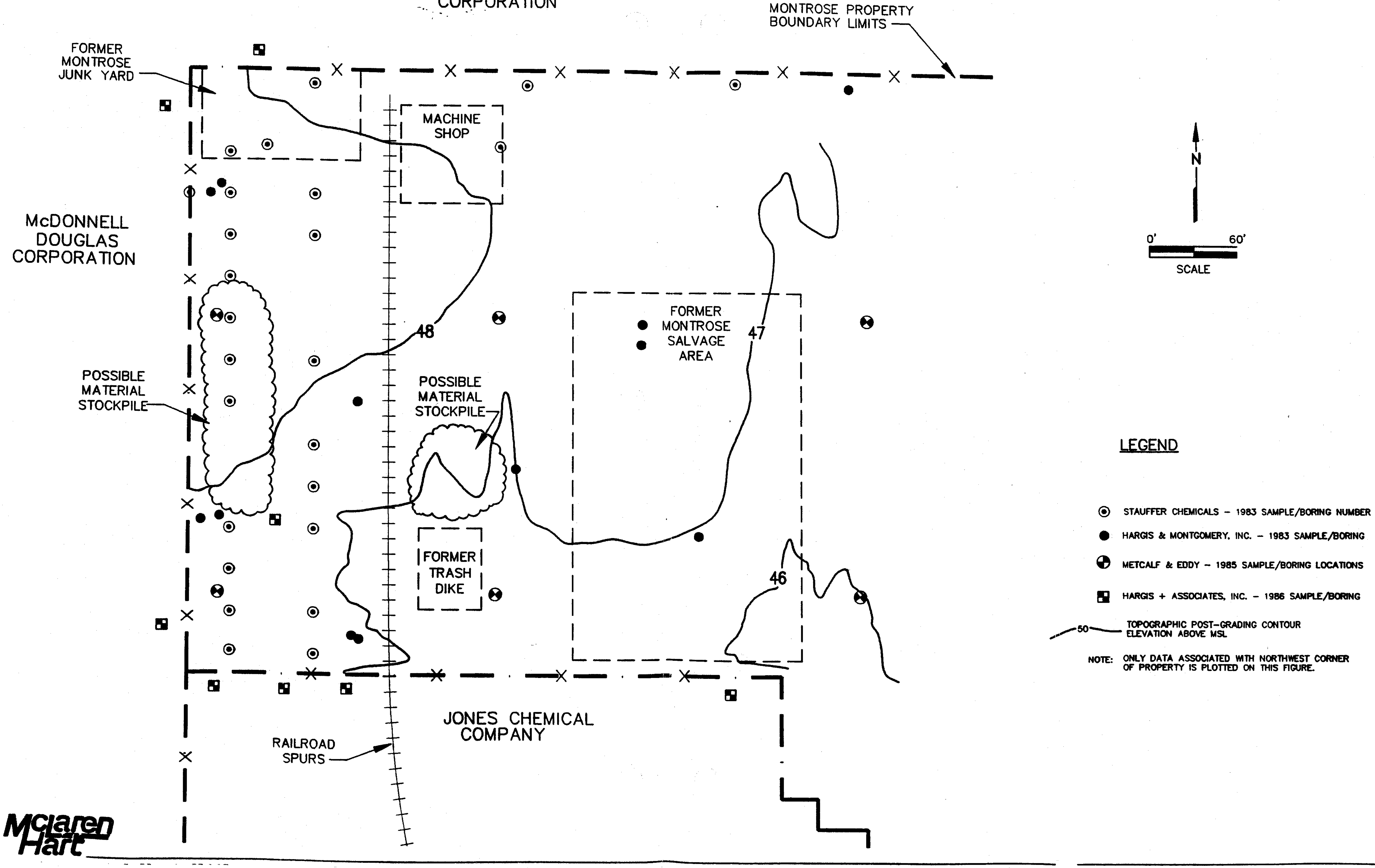

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FIGURE 5
POST-GRADING SURFACE ELEVATION CHANGE
NORTHWEST CORNER OF
FORMER MONTROSE FACILITY

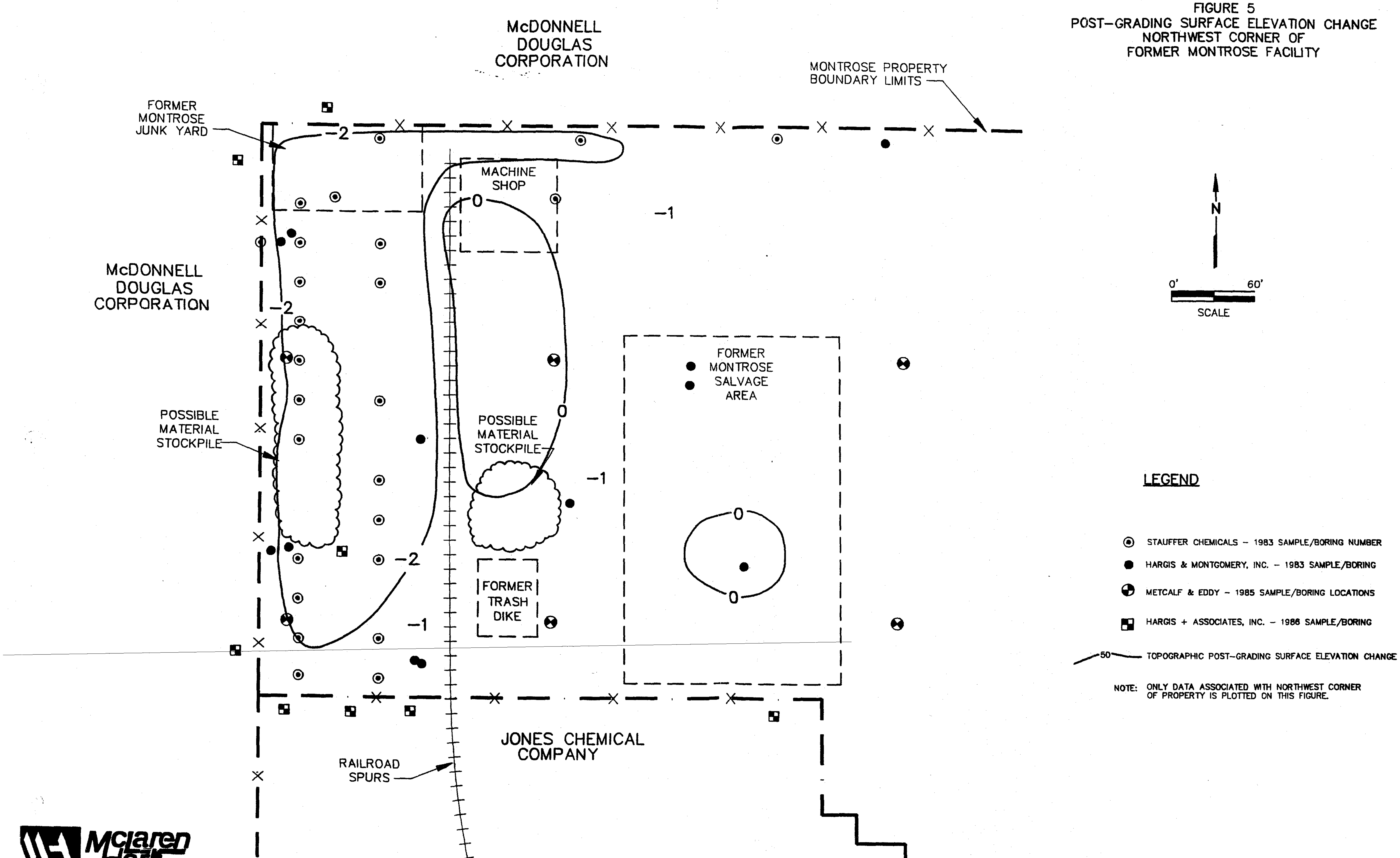

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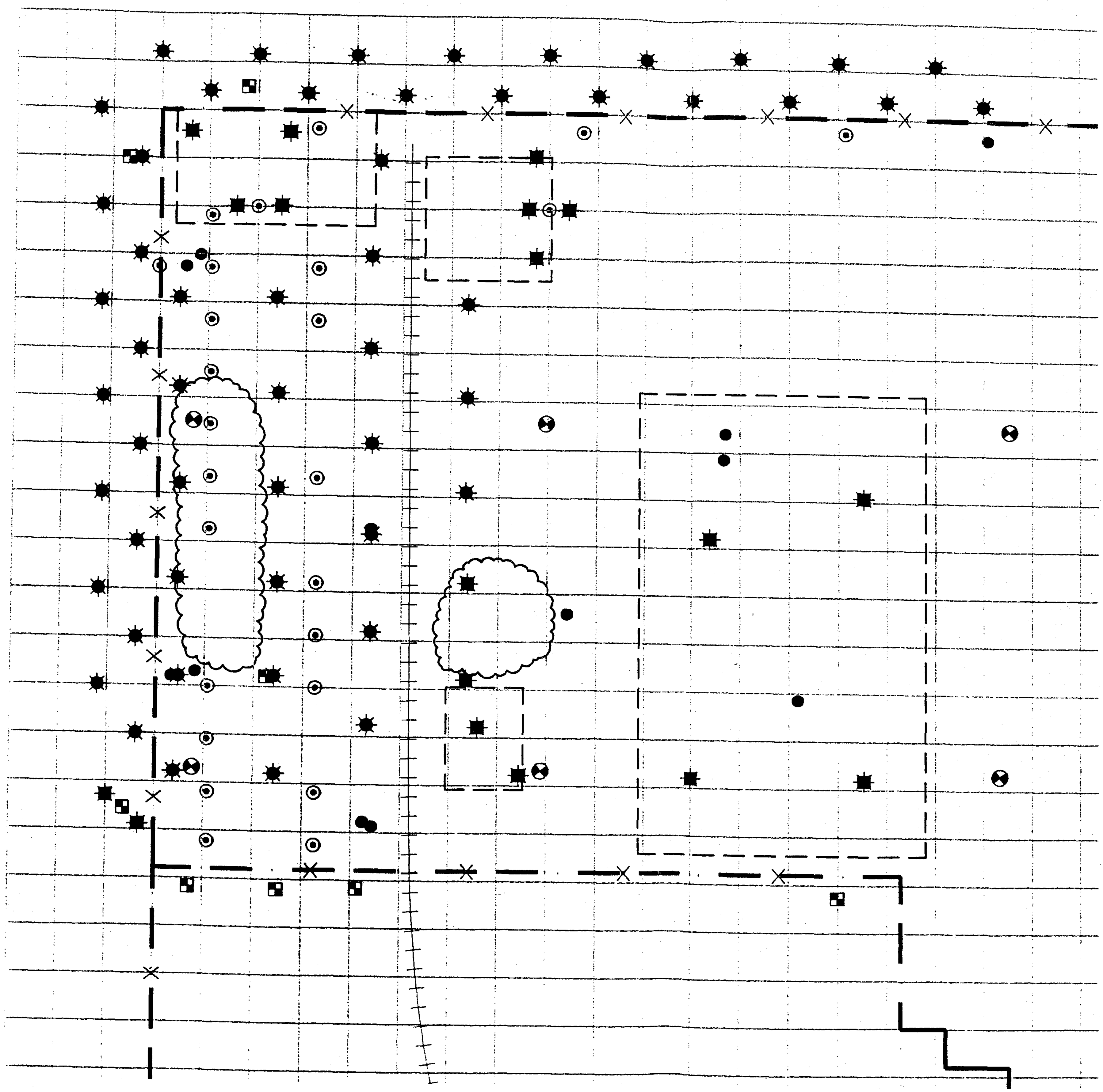
FIGURE 6
FORMER AND PROPOSED SOIL
SAMPLE LOCATIONS
NORTHWEST CORNER OF
FORMER MONTROSE



N

0' 60'
SCALE

LEGEND

- STAUFFER CHEMICALS – 1983 SAMPLE/BORING NUMBER
- HARGIS & MONTGOMERY, INC. – 1983 SAMPLE/BORING
- METCALF & EDDY – 1985 SAMPLE/BORING LOCATIONS
- HARGIS + ASSOCIATES, INC. – 1986 SAMPLE/BORING
- PROPOSED SAMPLING LOCATION (GRID POINT)
- PROPOSED SAMPLING LOCATION (BIASED POINT)

NOTE: ONLY DATA ASSOCIATED WITH NORTHWEST CORNER OF PROPERTY IS PLOTTED ON THIS FIGURE.

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Rancho Cordova
CA 95670
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Fax 916/852-7292

CHAIN OF CUSTODY RECORD 22458

SEE SIDE 2 FOR COMPLETE INSTRUCTIONS

Project Name: ____________________

Project Number: ____________________

Project Location: (State) ____________________

FOR LABORATORY USE ONLY

Laboratory Project #: ____________________ *Storage ID:* ____________________

Sample Condition Upon Receipt: Temp: ________ *°C* ________ *Geiger:* ________

Custody Seals Present? Yes/No Intact? Yes/No Samples Intact? Yes/No

____

Sample Disposal (check one)

☐ Laboratory Standard

☐ Other ________

Level of QC (see Side 2): ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6A ☐ 6B ☐ 6C ☐ 6D ☐ 6E ☐ 6F ☐ 7 ☐ 8 ☐ A

Write in → Analysis Method

ANALYSES REQUESTED

SAMPLE INFORMATION

FOR LABORATORY USE ONLY Lab ID	Sample ID Number	Date	Time	Description: Locator	Description: Depth	Container(s): #	Container(s): Type	Matrix Type	Pres. Type	TAT	ANALYSES REQUESTED									
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

SEND REPORT TO:

Company Name ____________________

Client Name ____________________

Address ____________________

Phone ________ Fax ________

BILL TO (if different):

Company Name ____________________

Address ____________________

PO # ____________________

Phone ________ Fax ________

Special Instructions/Comments ____________________

Sampler Name	Signature	PPE Worn in Field	
Relinquished By:	Date/Time	Received By or Method of Shipment/Shipment I.D.	Date/Time
Relinquished By:	Date/Time	Received By or Method of Shipment/Shipment I.D.	Date/Time
Relinquished By:	Date/Time	Received By or Method of Shipment/Shipment I.D.	Date/Time

Common Analytical Methods

413.1
413.2 Long Method
413.2 Short Method
418.1 Long Method
418.1 Short Method
420.1
502.2
503E
503.1
524.2
601
602
604
608
610
624
625
8010
8015
8015 Mod.
8020
8021
8040
8080
8100
8150
8240
8270
8310
Acidity
Alkalinity
BTEX
Chloride
CLP (see Side 2)
COD
Color
Conductivity
Corrosivity
Cyanide
Flashpoint
Fluoride
General Mineral
Hex. Chromium
Ion Balance
Metals (write specific metal & method #)*
Metals 6010*
Metals PP*
Metals Title 22:
TTLC Level
STLC Level
(see Side 2)
Nitrate
Nitrite
Odor
Org. Lead
Org. Mercury
Percent Moisture
Percent Solid
Perchlorate
pH
Phosphates
Phosphorus
Sulfate
Sulfides
TCLP:
VOA
Semivoa
Metals
Pesticide
TDS
Total Hardness
Total Solids
TPH/D
TPH/G
TSS
Turbidity

* Specify Total or Dissolved

FIGURE 7
EXAMPLE
CHAIN OF CUSTODY

BOE-C6-0063970

FIGURE 8

SOIL DRILLING LOG

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SB/MW # : ____
D- ____
Page ____ of ____
Sampler: ____

PROJECT ____ LOCATION ____
ELEVATION ____ MONITORING DEVICE ____
SAMPLING DATE(S) ____ START ____ FINISH ____
SAMPLING METHOD ____ SUBCONTRACTOR & EQUIPMENT ____
MEMO ____

Depth Below Surface(ft.)	Penetration Results		Sampler Depth Interval (ft.)	Sample ID #	HNu reading (ppm)	Soil Description Color, Texture, Moisture, Etc.	Unified Classification	Graphic Log	Sub-Sample	Borehole Abandonment/ Well Construction Details
	Blows 6"-6"-6"	BPF								

SIGNATURE OF FIELD SUPERVISOR ____

TITLE ____

SIGNATURE OF REVIEWER ____

TITLE ____

Appendix A

Geoprobe Standard Sampling Protocol

1.0 TITLE: **Operation of the 8-M Geoprobe System**

2.0 REFERENCES:

8-M Operations Manual, Geoprobe Systems, July 27, 1990.

3.0 SCOPE AND APPLICATION:

This Standard Operating Procedure (SOP) is intended to supplement the procedures presented in the Geoprobe 8-M Operations Manual. This SOP covers collection of soil vapor, soil core, and groundwater samples using the Geoprobe.

4.0 SUMMARY OF METHOD:

The Geoprobe is a vehicle-mounted hydraulic soil-probing device which applie both static force and percussion hammering for tool placement. Depending on the type of media to be collected, different sampling attachments are used. Sampling attachments include tube adapters for collection of soil vapor, piston driven tubes for collection of soil samples, and mill-slotted rods fo collection of groundwater samples.

5.0 LIMITATIONS:

Operators should consider the following limitations when using the Geoprobe:

- The sampling attachments may not reach the desired depth due to subsurface geologic features such as hardpan, cobbles, rocks, roots, or buried objects.
- The amount of sample collected may be less than the desired volume.
- The probe borehole may create a conduit for entry into the subsurface and the hole may need to be filled with grout before abandonment.
- The presence of subsurface utilities may hinder the use of the Geoprobe in some areas.

In addition, all Geoprobe operators should be familiar with the safety precautions contained in Section 9.0 of this SOP.

6.0 APPARATUS AND MATERIALS:

6.1 GENERAL TOOLS

- Probe Rods (36", 24", and 12")
- Cleaning Brush
- Cleaning Brush Adapter
- Drive Caps
- Pull Caps
- Probe Rod Pull Plate
- Solid Drive Points
- Rod Extractors
- GSK-58 Hammer Anvils
- Drill Steel (36")
- Carbide-Tipped Drill Bit (2" Diameter)
- Thread Chaser
- GSK-58 Hammer Latch
- Hammer Latch Tool
- GSK-58 Wire Ring

6.2 SOIL VAPOR SAMPLING TOOLS

- Stainless 3/16" Post-Run Tubing (PRT) Adapters
- "O"-rings for PRT Adapters
- PRT Expendable Point Holders
- Expendable Drive Points
- Drive Point "O"-rings
- Retractable Point Assemblies
- Retractable Point "O"-rings
- Teflon Tubing (1/4" O.D. × 3/16" I.D.)
- Post Run Point Popper

6.3 SOIL SAMPLING TOOLS

- Large Bore Sampler Assembled Kits
- Large Bore Cutting Shoes (extras)
- Large Bore Acetate Liners
- Piston Stop-Pins (extras)
- Extension Rods, Couplers, and Handle
- Vinyl End Caps

6.4 GROUNDWATER SAMPLING TOOLS

- Complete Mill-Slotted Assemblies
- Tubing Bottom Check Valves
- Check Balls
- Polyethylene Tubing (3/8" O.D. x 1/4" I.D.)
- GW Expendable Drive Points
- GW Drive Point "O"-rings

6.5 HEALTH AND SAFETY EQUIPMENT

- Safety Glasses
- Ear Protection
- Steel-toed shoes
- Hardhats
- Leather Gloves
- Wheel Chocks
- Vehicle Exhaust Ventilation Hoses

7.0 PROCEDURE:

7.1 GEOPROBE POSITIONING:

7.1.1 Position the vehicle at the desired sampling location. Place th transmission in park, set the parking brake, turn off the igniti and chock the wheels.

7.1.2 The remote ignition switch is located on the control panel near the Geoprobe operator position on the inner wall of the vehicle and the ELECTRICAL control switch for the hydraulic system is located on the control panel at the Geoprobe operator position. Before starting the vehicle engine using the remote ignition switch, ensure the ELECTRICAL control switch for the hydraulic system is in the "off" position (Figure 7.1.1).

7.1.3 Activate the Geoprobe hydraulic system by turning the ELECTRICAL control switch to the "slow" speed. Always use the "slow" hydraulic speed when moving the probe (Figure 7.1.1).

7.1.4 Movement of the Geoprobe is controlled by levers located on a control panel at the Geoprobe operator position. The operator moves each lever up or down to control individual cylinder movement (Figures 7.1.1 and 7.1.2).

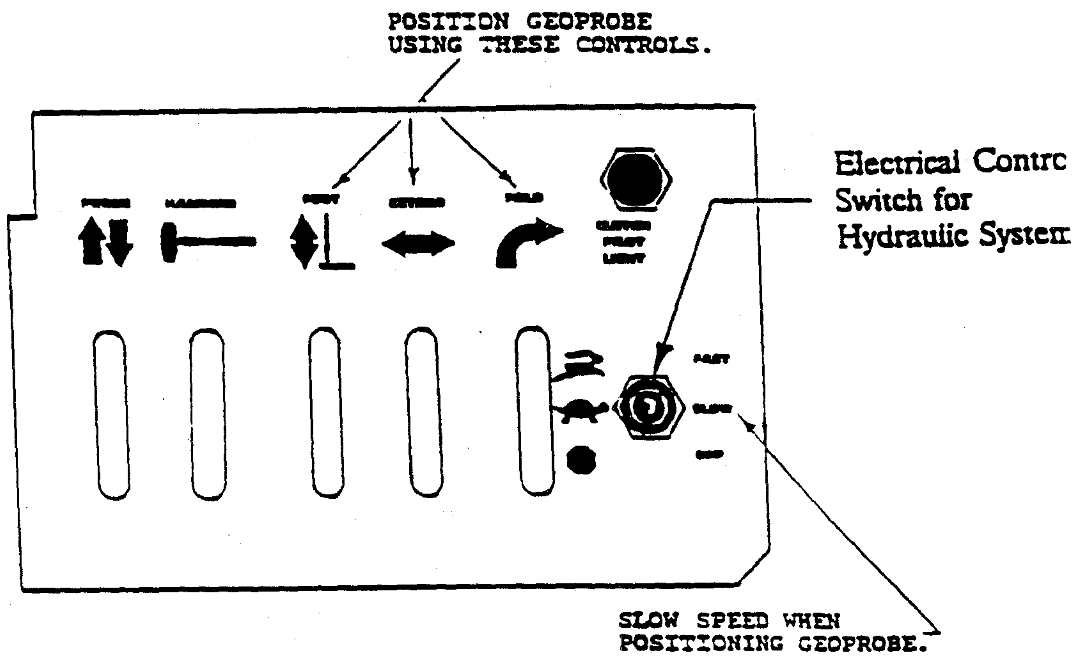


FIGURE 7.1.1 CONTROL PANEL OF GEOPROBE

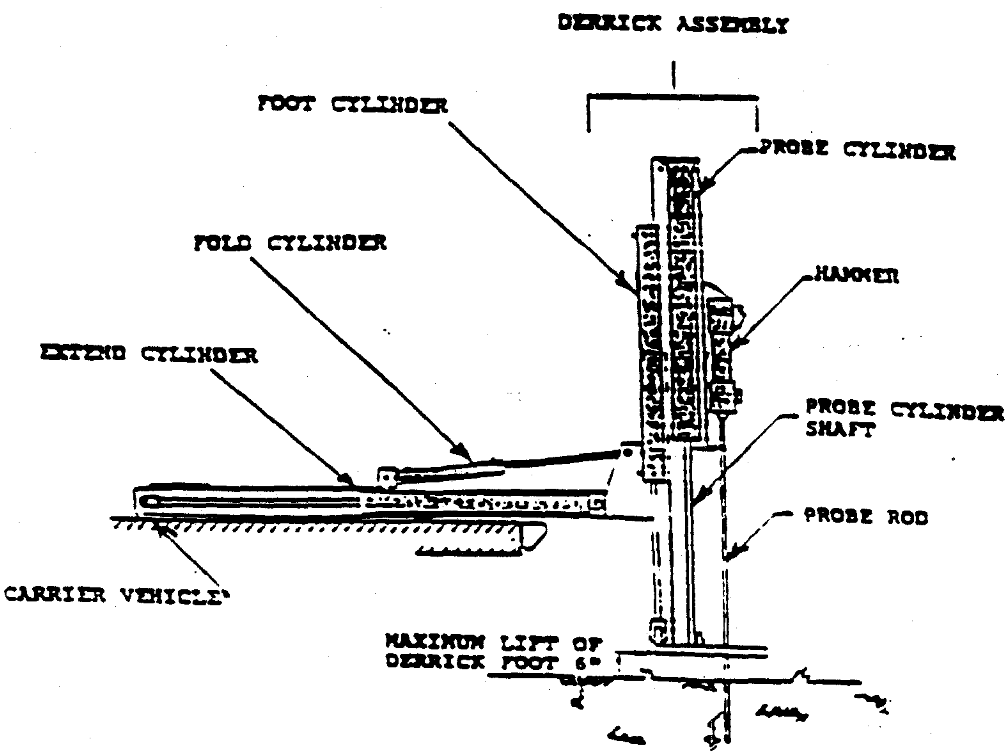


FIGURE 7.1.2 CYLINDERS OF GEOPROBE

7.1.4.1 FOOT control lever: This control activates the Foot cylinder which moves the derrick assembly up and down.

7.1.4.2 EXTEND control lever: This control activates the Extension cylinder which moves the Geoprobe in and out of the vehicle.

7.1.4.3 FOLD control lever: This control activates the Fold cylinder and rotates the Geoprobe up to 90°.

7.1.4.4 HAMMER control lever: This control activates the hammer.

7.1.4.5 PROBE control lever: This control activates the Probe cylinder which moves the Probe and Hammer up and down. The PROBE control is used to drive the probe rods to the sampling depth using the static weight of the vehicle.

7.1.5 Use the FOLD, FOOT, and EXTEND controls to remove the Geoprobe from the vehicle without clipping the ceiling of the vehicle. Place the Geoprobe in the exact sampling position, being certain the probe cylinder shaft is perpendicular to the ground. The Geoprobe should not be fully extended from the vehicle during operation.

7.1.6 Use the FOOT control to raise the rear of the vehicle to apply static pressure to the probe unit. The rear of the vehicle should not be raised more than 6 inches off the ground. The wheels of the vehicle must remain in contact with the ground surface to prevent shifting or tipping during Geoprobe operation.

7.2 PROBING: GENERAL

Operation of the Geoprobe may be done using one of three methods, alone or in combination. The first method, static force probing, is accomplished using the weight of the vehicle alone. In some soils, the probe will not advance solely with static force and the second method, percussion hammering, is necessary. In cases where it is necessary to drill through asphalt or hard surface soils, the third method, drilling, is applicable. The hammer is used in combination with a carbide-tipped bit to drill up to 2 feet below the surface. The last two methods require the use of both the PROBE and HAMMER controls to advance the probe.

7.3 PROBING: STATIC FORCE

7.3.1 Turn off the hydraulic system by positioning the ELECTRICAL control switch to "stop." Lift the hammer latch up, insert a hammer anvil, and close the hammer latch (Figure 7.3.1).

7.3.2 Screw a drive cap on the first probe rod (Figure 7.3.2).

7.3.3 Screw an expendable point holder onto the first probe rod.

7.3.4 Slip an expendable drive point into the point holder.

7.3.5 Position probe rod in the center of the derrick foot below the hammer anvil. The probe rod and probe cylinder shaft must be vertically aligned.

7.3.6 Turn the ELECTRICAL control switch to "slow" to activate the hydraulics. Push down on the PROBE control lever to begin probing.

7.3.7 The vertical alignment of the probe rod and probe cylinder shaft must be kept constant during probing and can be adjusted using the FOLD control.

7.4 PROBING: PERCUSSION HAMMER

7.4.1 Follow procedures in Section 7.1 for positioning the first probe rod.

7.4.2 Apply the percussion hammer to the probe rod, with attached drive point, by pushing down on the HAMMER control lever. The hammer anvil must be kept on the drive cap to prevent vibration. Maintain static force on the probe rod by pushing down on the PROBE control lever.

7.4.3 Penetration of the probe rod is controlled by the PROBE control and should be done in 2 inch increments. The rods must be hand tightened during probing if the threads loosen due to hammering. The rods must be tightened while static force is applied, therefore a second person is necessary for this operation.

7.4.4 The derrick foot should not rise more than 6 inches off the ground. If the derrick foot lifts, release the PROBE control. This will return the derrick foot to its original position.

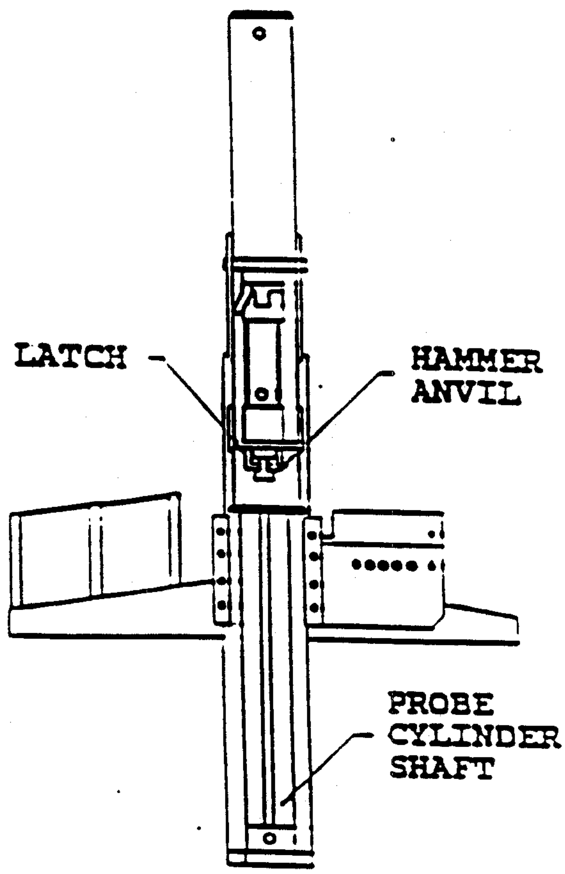
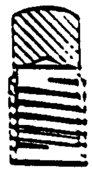


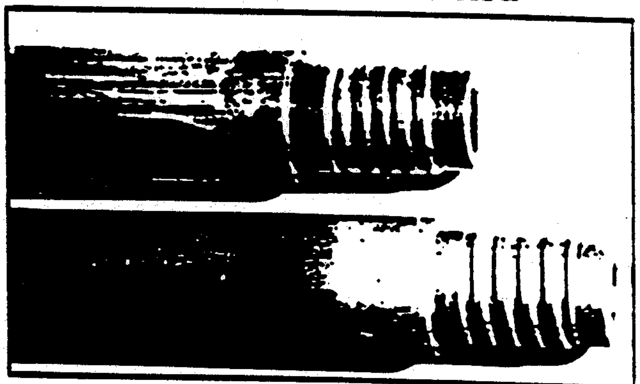
FIGURE 7.3.1 HAMMER LATCH AND HAMMER ANVIL

Geoprobe Drive Cap
Part No. AT-11B
Threaded top cap for driving Geoprobe brand probe rod.



AT-11B

Threaded Probe Rod



Older "A" style thread (top)
Improved "B" style thread (bottom)

FIGURE 7.3.2 DRIVE CAP AND PROBE RODS

7.4.5 The FOLD control may be used to maintain a 90° angle as the derrick foot is raised off the ground.

7.5 PROBING: DRILLING

Hearing and eye protection must be worn when drilling.

7.5.1 Position the probe at the desired sampling location as described in Section 7.1.

7.5.2 Position the ELECTRICAL control switch for the hydraulics to "off" and insert the drill steel with carbide-tipped bit into the hammer.

7.5.3 Activate the HAMMER ROTATION control by turning the knob counter-clockwise (Figure 7.5.1). This allows the drill bit to rotate when the HAMMER control is pressed.

7.5.4 Press down on the HAMMER control and periodically depress the PROBE control to lower the probe incrementally. The HAMMER control must be kept fully depressed during drilling.

7.5.5 If the drill stops rotating, raise the probe slightly with the PROBE control lever until the drill rotates, and then continue drilling.

7.5.6 When the drill has reached soil, release the HAMMER control, turn the HAMMER ROTATION control knob clockwise to deactivate rotation, and retract the rod as described in Section 7.7. Remove the drill steel and continue probing as described in Sections 7.4 and 7.6. The drill can be used to penetrate up to two feet of asphalt, concrete, or hard soils.

7.6 PROBING: ADDING RODS

7.6.1 Turn off the ELECTRICAL control switch for the hydraulics.

7.6.2 Remove the drive cap from the probe rod that is in the ground. Turn on the hydraulics and lift the probe cylinder to its maximum height. Turn the hydraulics off.

7.6.3 Screw the drive cap onto the probe rod to be added. Screw this probe rod to the probe rod already in the ground.

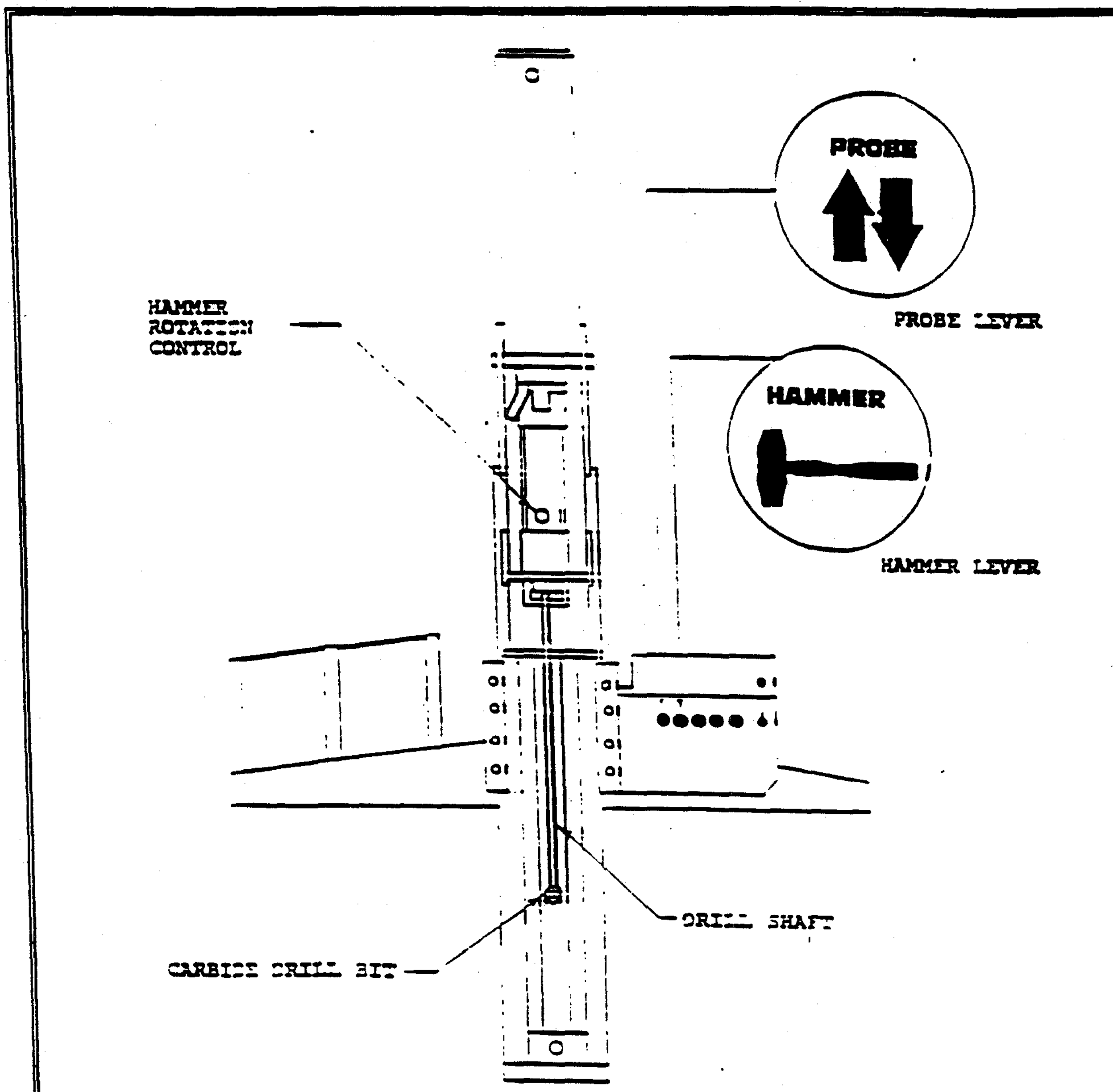


FIGURE 7.5.1 HAMMER ROTATION CONTROL KNOB

7.6.4 Continue this procedure until the desired sampling depth is reached A sampling log that indicates the number and length of each rod used, the sampling equipment used, and the depth at which sample collection begins and ends should be kept by operators.

7.7 PROBING: PULLING RODS

7.7.1 Turn off the hydraulics.

7.7.2 Lift the hammer latch and remove the hammer anvil.

7.7.3 Replace the drive cap on the extruding probe rod with the pull cap.

7.7.4 Lift up the hammer latch, activate the hydraulics, lower the hammer to the pull cap, and close the hammer latch over the pull cap (Figure 7.7.1).

7.7.5 Retract the probe rod by holding up the PROBE control lever. The probe cylinder should not be lifted to its full height. Lower the probe cylinder slightly to release the pressure on the hammer latch, raise the latch, remove the pull cap from the rod, and remove the top rod. Repeat this procedure with any remaining rods.

7.8 SAMPLE COLLECTION: SOIL VAPOR

7.8.1 Assemble a probe rod with a PRT retractable or expendable point system.

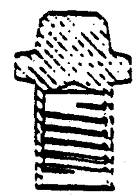
7.8.2 Advance the probe to desired sample depth according to the procedures in Sections 7.3 and 7.4.

7.8.3 Using a pull cap, retract the probe rod approximately 6 inches.

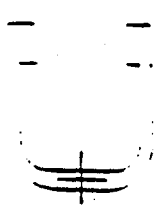
7.8.4 Assemble a PRT tubing adapter with sufficient length of teflon tubing, lower the assembly into the probe rods, and install the adapter by rotating the tubing counter-clockwise until the threads have tightened (Figure 7.8.1). PRT tubing adapters have reverse threads.

7.8.5 Collect samples by following the procedures in FASP SOP F93012, "Collection of Gaseous Samples by Using Tedlar Bags."

Geoprobe Pull Cap
Part No. AT-12B
Female threaded for pulling Geoprobe probe rods. Hammer latch fits over flanged top. Not required when using manual probe rod jack.



AT-12B



RP-25

GSK-58 Hammer Latch
Part No. RP-25
Replacement hammer latch. Fits GSK-58 Hammer on Geoprobe 8-M model machines.

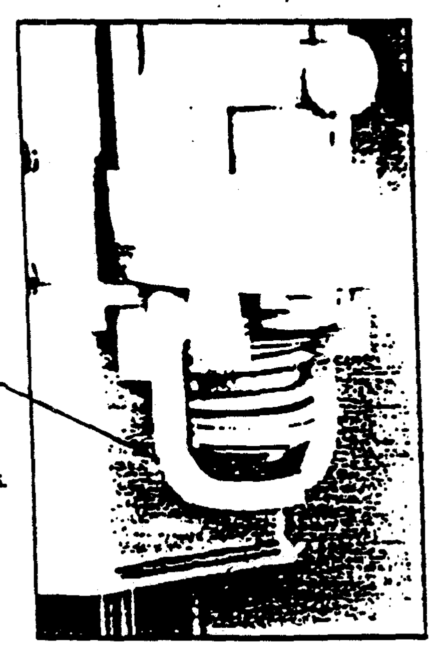


FIGURE 7.7.1 HAMMER LATCH AND PULL CAP

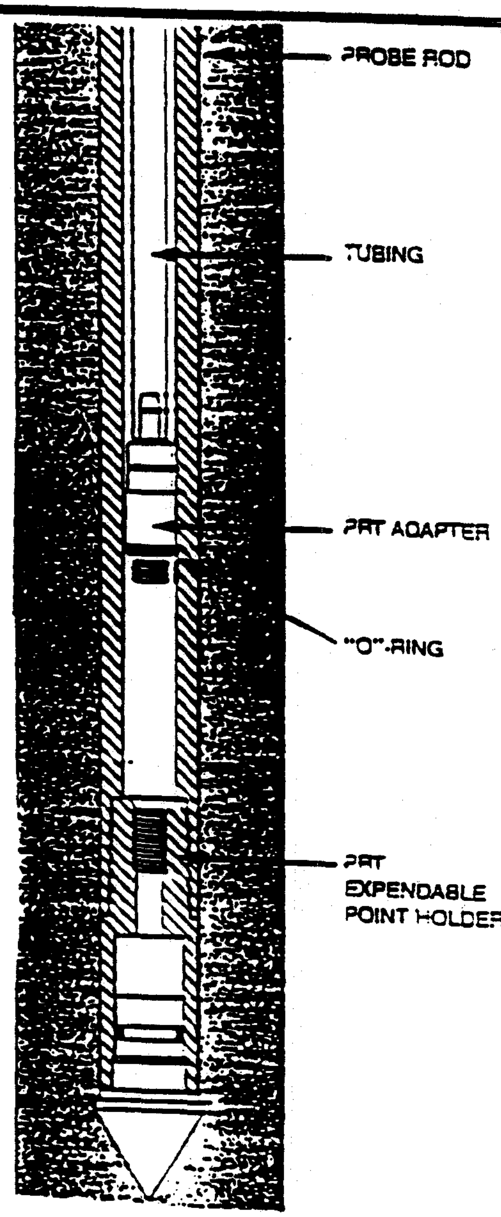


FIGURE 7.8.1 PRT SOIL GAS ADAPTER AND EXPENDABLE POINT

7.9 SAMPLE COLLECTION: SOIL CORE

7.9.1 Large Bore Sampler: The piston tip is screwed onto the piston rod. The acetate liner is hand-flared and attached to a cutting-shoe. The piston rod is placed into the acetate liner, with the piston tip flush within the cutting-shoe. This assembly is placed into the sample tube, the cutting-shoe and drive head are screwed into the sample tube, and the stop-pin is screwed into the drive head. This sampler is used when large volumes are needed or visual examination of core is required (Figure 7.9.1).

7.9.2 The assembled sampler is attached to the leading probe rod. It is then driven using standard probe procedures, described in Sections 7.3 and 7.4, to the top of the interval to be sampled. Under some circumstances, the hole may be pre-probed using a retractable drive point.

7.9.3 To remove the piston tip from the drive head, retract the probe unit from the probe rod, remove the drive cap from the last probe rod, and lower the extension rod inside the probe rods. Rotate the extension rod clockwise until the leading extension rod is screwed into the stop-pin. Continue to rotate clockwise until the stop-pin is removed from the drive head. Removing the stop-pin from the sampler will allow the piston to move up when the sampler is driven down. Remove the extension rod and the attached stop-pin.

7.9.4 Replace the drive cap on the last probe rod and mark the rod with an indelible pen at the appropriate distance above the ground surface for sample collection.

7.9.5 Drive the probe rod the designated distance. Retract the probe rods as described in Section 7.7.

7.10 SAMPLE COLLECTION: GROUNDWATER

7.10.1 Position the Geoprobe as described in Section 7.1.

7.10.2 Groundwater is collected using a mill-slotted assembly (Figure 7.10.2). This assembly screws onto the leading probe rod. The mill-slotted rod section is cut with slots 2 inches long by 0.020 inches wide. This section is fitted with a mill slot drive head and solid drive point. The mill-slotted rod section is open to the soil as it is driven to the desired sample depth.

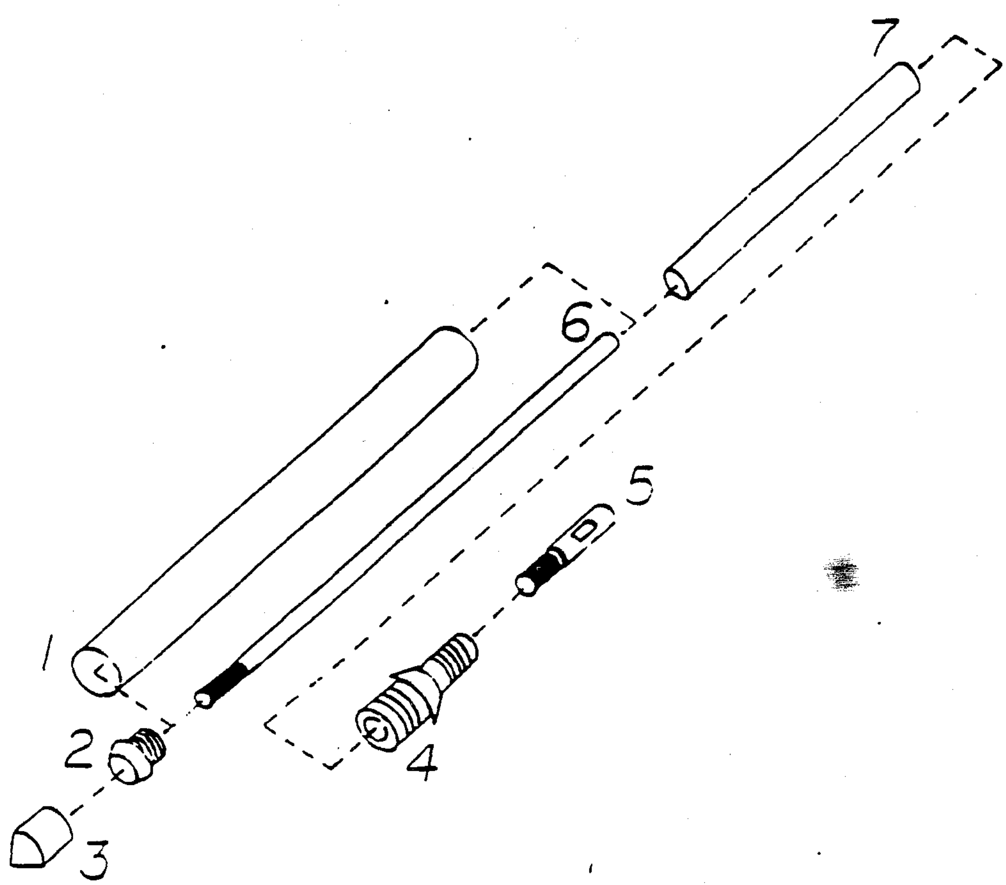
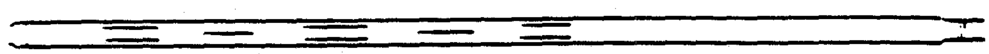


FIGURE 7.9.1 LARGE BORE SOIL SAMPLER

(1) Sample Tube, (2) Cutting-Shoe, (3) Piston Tip, (4) Drive Head, (5) Stop-Pin, (6) Piston Rod, and (7) Acetate Liner.

Mill-Slotted Well Point
Part No. GW-43K
Threads into leading Geoprobe probe rod. 3' length x 1" O.D.
Has 15 mill-cut slots, each 2" in length x .020" in width.



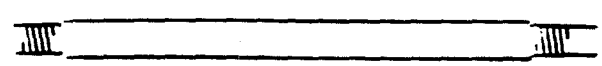
GW-43K
(Assembled Sampler)

Sub Assembly Parts
Solid Drive Point
Part No. AT-142B

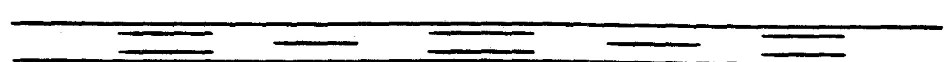
Mill Slot Drive Head
Part No. GW-43B

Mill-Slotted Rod Section
Part No. GW-44

AT-142B



GW-43B



GW-44

FIGURE 7.10.2 COMPLETE MILL-SLOTTED GROUNDWATER SAMPLER ASSEMBLY

7.10.3 The sampler is driven into the water-bearing formation, and the probe is retracted two feet as described in Section 7.7.

7.10.5 Remove the drive cap. Groundwater samples are collected in polyethylene tubing converted into a mini-bailer by attachment of a tubing bottom check valve. This mini-bailer is filled by submergence in groundwater and by either gentle manual vertical oscillation or by using an oscillation pump (Figure 7.10.3). The mini-bailer can either be raised full of water and the sample collected or, if the sample is collected in the mini-bailer near the ground surface, the vertical oscillation of the tubing may pump water to the surface.

8.0 DECONTAMINATION

8.1 New lengths of polyethylene tubing should be used for each sample. If decontamination is necessary, rinse tubing with methanol or hexane, a non-phosphate detergent, and organic free water, and allow to air dry.

8.2 All Geoprobe sampling tools, including probe rods, should be decontaminated by steam-cleaning or by the procedures in Section 8.1. All probe rods should be steam-cleaned before initial use and between use at each sample location.

9.0 SAFETY

Health and Safety equipment is listed in Section 6.5.

9.1 Always place the vehicle transmission in park and set the emergency brake before engaging the remote ignition.

9.2 The rear of the vehicle should not be fully raised with the probe foot, as the vehicle may fall or move, causing injury.

9.3 Always extend the probe unit out from the vehicle and deploy the foot to clear the vehicle ceiling before folding the probe unit out.

9.4 Operators should wear OSHA-approved steel-toed boots and keep feet clear of the probe foot.

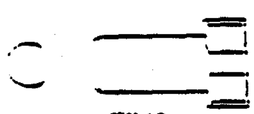
9.5 One person should operate the Geoprobe hydraulics while another handles probe rods and accessories.

9.6 Never place a hand on top of a rod while the probe is being lowered.

Tubing Bottom Check Valve

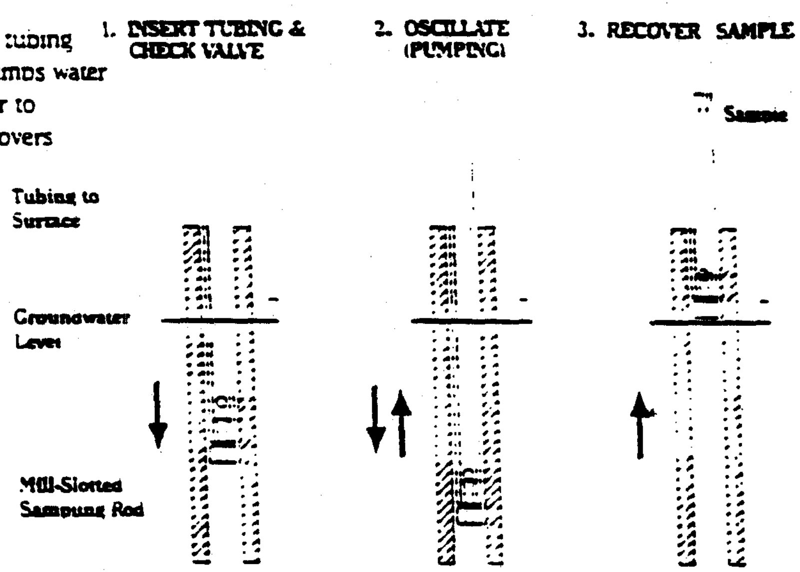
Part No. GW-42

Fits ¼" I.D. Tubing. Converts standard tubing into a mini-bailer. Oscillating motion pumps water column up into tubing. Can pump water to surface in some formations. Tubing recovers 9.65 ml per foot.



GW-42

Groundwater Sampling With Tubing Bottom Check Valve



Check Balls

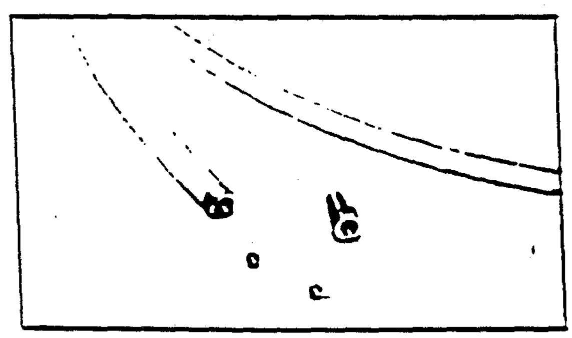
Part No. GW-42-1

Replacement check balls for GW-42. Package of 25.

¼" I.D. Polyethylene Tubing

Part No. TB-25L

⅜" O.D. x ¼" I.D. .060" wall tubing. For water sampling with GW-42 tubing bottom check valve. Discard tubing after each sample. 500 ft. roll.



Tubing Bottom Check Valve and ¼" Polyethylene Tubing

FIGURE 7.10.3 MINI-BAILER USED FOR GROUNDWATER SAMPLE COLLECTION

9.7 Turn off the hydraulic system before changing rods, inserting the hammer anvil, or attaching accessories.

9.8 The operator must stand to the control side of the probe machine, clear of the probe foot and mast.

9.9 Wear safety glasses at all times during the operation of the Geoprobe.

9.10 Never exert down pressure on a probe rod so as to lift the rear tires of the vehicle off the ground.

9.11 Never exert down pressure on a probe rod so as to lift the rear of the vehicle over six inches off the ground.

9.12 Always remove the hammer anvil or other tool from the machine before folding the machine to the horizontal position.

9.13 The vehicle catalytic converter is hot and may present a fire hazard when operating over dry grass or other combustibles.

9.14 Geoprobe operators must wear ear protection. OSHA approved ear protection for sound levels exceeding 85 dba is recommended.

9.15 The location of buried or underground utilities and services must be known before starting to drill or probe.

9.16 Shut down the hydraulic system and stop the vehicle engine before attempting to clean or service the equipment.

SOIL SAMPLING TOOLS - Macro-Core - Operation

Basics

The Macro-Core Sampler is designed to start collecting a sample upon initial driving into the subsurface. To sample deeper, the soil above the desired sampling interval must be removed. The sampler may be lowered to each new sampling depth by lowering the sampler down the previously sampled hole (**Figure 1.**) and connecting probe rods together until it reaches the top of the new sampling interval. The cutting shoe is tapered to minimize scraping soil off the walls of the hole. In some soils the hole may not stay entirely open due to soil sloughing. Visual inspection of the sample may reveal loose soil or significantly different soil at the top end of the tube due to sloughing. Some compensation can be figured into a sample log. However, if excessive sloughing is a problem, operators may choose to use the Large Bore soil sampler as described in the previous section.

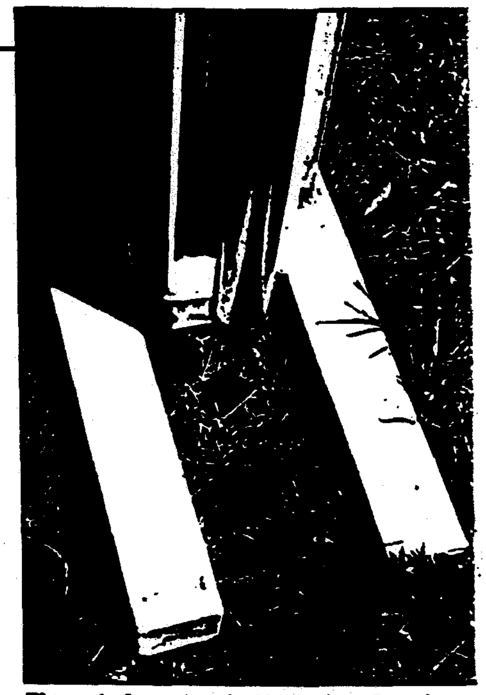


Figure 1. Lowering the Macro-Core Sampler down the previously made hole.

Parts

Geoprobe probe rods and driving accessories and the following tools are required for operation:

Assembled Macro-Core Sampler:

AT-720 MC Cutting Shoe | **AT-722 MC Sample Tube**
AT-721 MC Drive Head | **AT-725 MC PETG (clear plastic) liner**

Additional: AT-726 MC Vinyl End Caps
AT-727 MC Shoe Wrench

Assembly

Clean all parts thoroughly before assembly. Push the pre-flared end of the liner over the interior end of the cutting shoe as shown in **Figure 2.** Insert the liner into the sample tube and screw the cutting shoe into the sample tube. The Shoe Wrench (Part No. AT-727) may be used to tighten the cutting shoe. Screw the drive head into the opposite end of the sample tube.

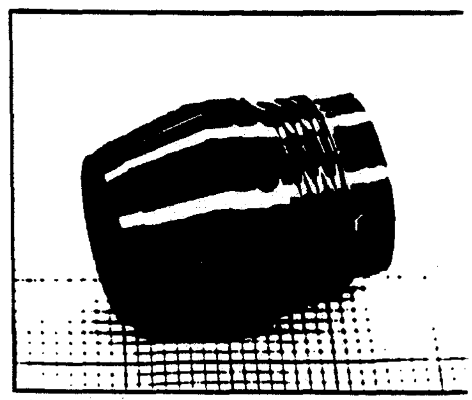
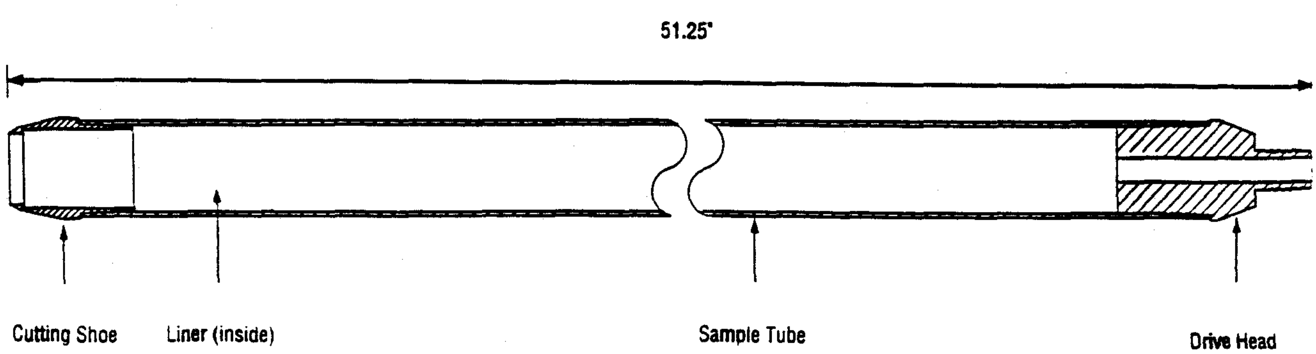


Figure 2. Pre-flared end of PETG liner snaps over interior end of cutting shoe.



Macro-Core Sampler Parts

Sampling

When driving the sampler from the surface, follow these instructions:

1. Connect a drive cap to the drive head at the top end of the sampler.
2. If using a Geoprobe machine for driving, raise the probe shell to the highest position. Next, raise the foot up off the surface to allow room to place the sampler below the hammer. Be sure to keep the derrick straight.
3. Insert an anvil into the hammer and place the sampler and probe rod in the driving position as shown in **Figure 3**. Raise the hammer latch into the up position while initially driving the sampler to avoid contact with the drive head.
4. Use the FOOT control to apply down pressure and activate the hammer as necessary to begin sampling. When the foot reaches the ground surface, begin using the PROBE control to apply down pressure as in normal operation as shown in **Figure 4**.
5. Add a probe rod and drive the sampler until the drive head reaches the ground surface. (**Figure 5.**) Do not over-drive the sampler.

To take samples at consecutive intervals, lower the sampler down the previously made hole by connecting probe rods together until the bottom end of the sampler stops at the next sampling interval.

Figure 3. Sampler in driving position.

Figure 4. Driving the sampler below the ground surface.

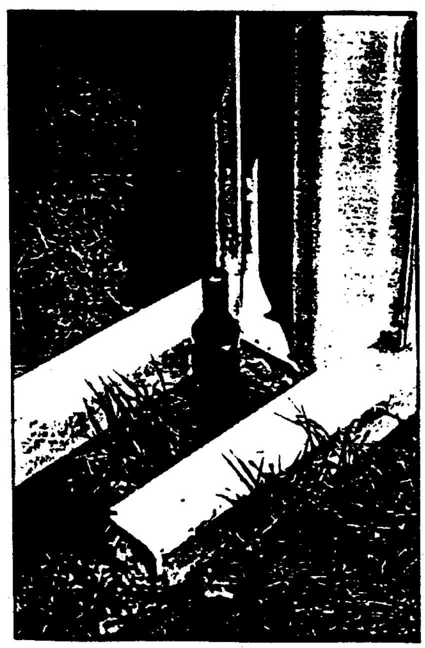


Figure 5. Sampler has been driven a full length when the drive head reaches the ground surface.

Removal

If sampling below four feet, pull out all of the probe rods until the sampler has been pulled out to just above the surface. When the sampler is visible above the surface, attach a pull cap to the top of the drive head. **(Figure 6.)** Continue to pull the sampler out of the hole using the probe control. When the limit of the 40" probe stroke (Series 8 Geoprobe machines) has been reached, continue to pull the sampler up using the FOOT control.

If the sampler is lodged tightly in the ground, the back of the carrier vehicle may be pulled downward in response to the resistance as pulling with the FOOT cylinder is attempted. This can damage the base frame of the Geoprobe machine. If the sampler cannot be retrieved easily (without excessive resistance), follow these steps:

1. Lower the FOOT and disengage the hammer latch from the pull cap.
2. Raise the FOOT at least 12" above the ground surface and place a foot extension or large timbers firmly beneath the FOOT. A foot extension may be improvised by stacking wooden boards as shown in **Figure 7.**
3. Lower the probe shell and close the hammer latch over the pull cap on the sampler. A 12" probe rod may be needed to lift the sampler up high enough for the latch to close over the pull cap.
4. Use the PROBE control to lift the sampler out the remainder of the way.

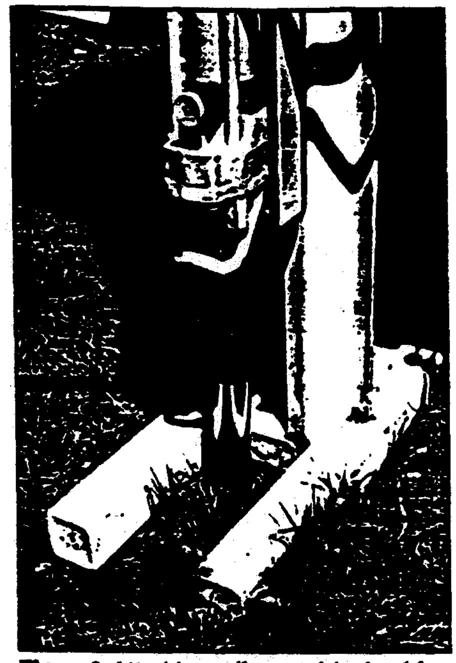


Figure 6. Attaching pull cap to drive head for removing sampler from ground.

Recovering the Sample

Once the sampler has been removed from the hole, the soil sample is easily recovered by unscrewing the cutting shoe and pulling the liner out. The exterior of the cutting shoe features a notch for attaching the Shoe Wrench (Part No. AT-727) to loosen tight threads. **(Figure 8.)** Applying a sharp blow to the notch with a flat screwdriver and a hammer is also useful for loosening the cutting shoe.

Figure 8. Removing the cutting shoe and liner from the Macro-Core sample tube using the AT-727 Shoe Wrench.

Figure 7. Pulling sampler with foot off of ground.

SOIL SAMPLING TOOLS - Macro-Core Sampler - Parts

Macro-Core Sampler

AT-720 Series

The sampler features a nickel-plated sample tube that is 48" long x 2.0" in diameter, a hardened tool steel cutting shoe that has a 1.5" diameter opening, and a tapered drive head that fits standard Geoprobe probe rods. The overall length assembled is 51.25". Sample recovery is 45" long x 1.50" diameter (1302 ml) in a PETG liner.

PARTS

AT-720	MC Cutting Shoe
AT-721	MC Drive Head
AT-722	MC Sample Tube
AT-725	MC PETG (clear plastic) Liner
AT-726	MC Vinyl End Cap
AT-727	MC Shoe Wrench

KITS

Assembled Macro-Core Sampler*
Part No. AT-720K
Includes the following parts:
(1) **AT-720** MC Cutting Shoe
(1) **AT-721** MC Drive Head
(1) **AT-722** MC Sample Tube
*kit does not include liners and end caps

LINERS

AT-725K	MC PETG Liners (pre-flared, clear plastic) Box of 66 only
AT-726K	MC Vinyl End Caps (fit AT-725 liners) Box of 66 pairs (66 red/66 black)

Macro-Core Parts